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Department of Agricultural Technical Services

LANDBOUNAVORSING
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1978

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AGRICULTURAL RESEARCH
1.7.1977 - 30.6.1978

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LANDBOUNAVORSING
1.7.1977 - 30.6.1978

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SLEUTEL TOT PROJEKTEREEKS

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(A)LBN	Landbou-bemarkingsnavorsing	(A)LBN	Agricultural Marketing Research
(A)LPE	Landbouproduksie-ekonomie	(A)LPE	Agricultural Production Economics

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(A)PS	Plantbeskerming (Patologie)	(A)PS	Plant Protection (Pathology)
(A)P	Plantkunde	(A)P	Botany
(A)S	Grond en Besproeiing	(A)S	Soils and Irrigation
(A)(T)	Tuinbou	(A)T	Horticulture
(A)VS	Vee- en Suiwelkunde	(A)VS	Animal and Dairy Science
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OP	Veeartsenykundige Navorsing	OP	Veterinary Research
SG	Somergraan-sentrum	SG	Summer Grain Centre
(S)N	Sitrus en Subtropiese Vrugte	(S)N	Citrus and Subtropical Fruit
(S)T	Tabak	(S)T	Tobacco
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(S)WP	Vrugte en Vrugtetegnologie	(S)WP	Fruit and Fruit Technology

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K	Karoo	K	Karoo
N	Natal	N	Natal
O	Oranje-Vrystaat	O	Orange Free State
OK	Oos-Kaap	OK	Eastern Cape
T	Transvaal	T	Transvaal
W	Winterreën	W	Winter Rainfall
SW	Suidwes-Afrika Landboustreek	SW	South West Africa Agricultural Region

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Ul : Ukulinga
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Vl : Voorligting/Extension
Vv : Varkensvlei (Kaapse Vlakte/Cape Flats)
Wg : Welgevallen (Stellenbosch)
Wk : Windhoek

(K) na projeknommer dui koöperatiewe projek aan
(K) after project number indicates co-operative project

1. SUMMARIES OF FINAL REPORTS ON RESEARCH PROJECTS

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PLANT PRODUCTION

Field Crops

COTTON

DISEASES

O-Gl.132/2: INVESTIGATION OF THE ROOIDOOD PROBLEM OF COTTON IN THE WESTERN IRRIGATION AREAS: EVALUATION OF CHEMICAL, PHYSICAL AND CLIMATOLOGICAL FACTORS. 1971-1976

M.v.Z. Pellissier, A. v. Schalkwyk, P.C.J.C. Dendy and J. de V. Nel

”Rooidood”-infected cotton plants were transferred together with the soil in which they were growing from Kakamas to greenhouses at Glen, and treated with various combinations of N, P, K, Mg, Na, Zn and trace elements. No conspicuous differences between the treatments were perceptible. Cotton plants cultivated from seed, in pots filled with fresh soil from the same locality where the infected plants and soil were obtained, showed no symptoms of the ”Rooidood” disease.

Soil analysis showed that application of 424 kg superphosphate ha^{-1} failed to increase the extractable phosphorus in the soil. However application of 1 272 kg superphosphate ha^{-1} increased the extractable phosphorus by as much as five-fold. Application of 530 kg potassium sulphate ha^{-1} likewise had no appreciable effect on the extractable potassium, but application of as much as 3 180 kg/ha^{1} brought about a considerable increase. This demonstrated the high fixation ability of the soil for phosphorus and potassium.

Initial low values for potassium in cotton leaves could only be increased with very high applications of potassium sulphate (3 180 kg/ha^{1}). Uptake of potassium was correlated to a high degree with the extractable potassium in the soil (r = 0,832**) as well as with the exchangeable potassium percentage (EPP) (r = 0,835**). The (Ca + Mg)/K ratio in the leaves was therefore also highly correlated with extractable potassium and the EPP (r = 0,938** and r = 0,933** respectively). High potassium applications, giving rise to a high extractable potassium status in the soil, resulted in an increased potassium uptake and apparently inhibited that of calcium, sodium, phosphorus and nitrogen.

The chemical composition of 160-day-old cotton leaves and stems showed more significant effects due to treatments than the composition of 250-day-old leaves and stems. The different values were also lower in the older leaves, probably as a result of translocation. No definite relationship was found between the occurrence of ”Rooidood” symptoms and a deficiency of some or other of the elements in the leaves and stems. Spraying of cotton plants with Spoorspray very effectively increased the concentration of copper, zinc and manganese in the leaves. Even near toxic levels were achieved by this treatment. No relationship between these trace elements and symptoms of ”Rooidood” could be established.

Application of trace elements had no influence on yields and in general it was found that the highest yields were obtained by a good balance between N, P and K. During the 1973/74 season, however, it seemed as if potassium applications tended to inhibit the yield although no significant differences were found. The yield was correlated to the (Ca + Mg)/K ratio and the EPP (r = 0,701** and r = 0,592* respectively) of the soil but not to the ammonium acetate extractable potassium. Although the yield was significantly correlated with the potassium uptake (r = 0,597*) it could not be considered as a reliable indication because the following season no relationship was found between these two factors (r = 0,259*). While the (Ca + Mg)/K ratio in the soil was apparently the best norm for predicting the yield (r = 0,701**), no relationship was found between the yield and the (Ca + Mg)/K ratio in the leaves (r = 0,230*).

Treatment with different combinations of N, P, K, Mg, Na, Zn and Spoorspray could not annul the symptoms of ”Rooidood” in cotton plants. Not one of these treatments could prevent the symptoms from returning on regrowth after the plants were pruned back. No definite relationship could therefore be established between the occurrence of ”Rooidood” symptoms and the deficiency of some or other trace element in the leaves and stems of cotton.

COTTON

O-Gl.136/1:

EFFECT OF TREATMENT OF SEED WITH VARIOUS FUNGICIDES ON DAMPING-OFF DISEASE OF COTTON. 1968-1977

G.D. Pauer and G.J. de Swardt

Various fungicides were evaluated in a field experiment to determine their effectiveness in controlling damping-off disease of cotton seedlings. All the registered fungicides, as well as some not yet registered, resulted in control of the disease to a certain extent.

As the mercurial seed disinfectant (Trigosan) was not very effective it was concluded that prohibition of the sale of mercurial fungicides will not have a detrimental effect on the control of seedling diseases in cotton.

Contrary to expectation, treatment of seed with chloroneb (Demosan) resulted in an excellent stand of cotton seedlings while treatment with carboxin (Vitavax), a systemic fungicide, was unsuccessful.

In experiments carried out under controlled conditions in greenhouses in artificially inoculated soil, various isolates of *Rhizoctonia solani* seemed to differ in their sensitivity to fungicide. This may explain certain contradictory findings in the field experiments.

IRRIGATION

O-Gl.117/9:

MOISTURE REQUIREMENTS OF COTTON AT DIFFERENT PLANTING DATES, IRRIGATION LEVELS AND PLANT POPULATIONS. 1976-1977

G.S. Cloete

The experiment was carried out at the Vaalharts and Upington Agricultural Research Stations and was designed as a 3 x 3 x 3 factorial with two replications at Vaalharts and four replications at Upington. The second order interactions were completely confounded with subblocks.

Three planting dates were tested, namely 25 September, 20 October and 15 November. Irrigation frequencies were applied when the following quantities of moisture had evaporated from an American class A-pan: 75 mm (F = 1,00), 125 mm (F = 0,60), and 175 mm (F = 0,43). Seventy-five millimetres of water was applied at a time by means of flood irrigation. Three spacings in the row were tested, namely 80 mm, 160 mm, and 240 mm. Seed-cotton yields, fibre qualities, and physiological development were studied.

The two earliest planting dates at Vaalharts yielded the highest quantity of seed-cotton. The accumulative growing degree days at Vaalharts were less than those at Upington, where the effect of planting dates on the total seed-cotton yield was not significant.

At both localities the highest yield was obtained with the lowest irrigation level while the highest irrigation level (F = 1,00) had an adverse effect on root and plant development.

Spacing in the row had a significant effect on the first of three pickings at Vaalharts. The highest yield was obtained at the highest plant population level.

The two earliest planting dates had a beneficial effect on most of the fibre qualities including staple length, Micronaire, fibre fineness, and fibre maturity. The highest fibre percentage was obtained at the highest irrigation level at both localities. A late planting date combined with a high irrigation level (F = 1,00) may delay plant reproduction and this may adversely affect the fibre qualities in marginal cotton-growing areas. Spacings had a limited effect on the fibre qualities wiht a higher percentage of fibre being obtained at the lower plant population

By planting late, namely on 15 November, and at an irrigation level of F = 0,43, five irrigations may be saved at Vaalharts and ten at Upington in comparison to September planting and an irrigation level of F = 1,00. Early-autumn frost may cause damage to cotton at Vaalharts planted as late as November and so the obvious planting time for cotton in this area would be late October while at Upington cotton may be planted with success as late as mid-November.

It was indicated that cotton should be planted in moist soil with the first irrigation being applied at six to eight weeks after planting. According to the present experiment the subsequent irrigations should be applied whenever 175 mm of water has evaporated from a class A-pan. It was established that cotton plants should be spaced 80 mm apart in the row with an inter-row spacing of 900 mm.

It is suggested that the physiological development of cotton plants should be studied using only one treatment at a time and the effect of moisture stress during the flowering stage should preferably be studied intensively under controlled conditions.

FORAGE CROPS

PRODUCTION

O-Gl.142/1: EFFECT OF ROW SPACING, PLANTING DENSITY AND CUTTING FREQUENCY ON THE DRY-MATTER YIELD OF ANNUAL FORAGE SORGHUM. 1974-1977

C. Engelbrecht and H.L.J. Potgieter

The experiment was conducted with annual forage sorghum hybrids under dryland conditions at Glen in the Orange Free State, on a Hutton-Shorrocks soil, 1,5 m in depth. The design was a 3 x 3 x 3 x 3 factorial with three replications in a randomised block. The main treatments (row spacings, planting densities and cultivars) were split into sub-treatments (cutting frequencies).

The narrow spacing (400 mm row width) resulted in significantly higher yields than the wider spacings (800 and 1200 mm row width). Similarly the higher sowing densities (4 and 6 kg seed per ha) resulted in significant higher yields than the lowest sowing density (2 kg seed per ha). A thick-stemmed, broad-leafed type (Haygrazer) significantly outyielded the thin-stemmed, narrow-leafed type of forage sorghum (Trudan II). Cutting in the soft dough stage resulted in significantly higher dry-matter yields than cutting in the vegetative stage (600 mm plant height) in the case of all cultivars.

The findings were obtained under exceptionally favourable rainfall conditions during the testing period and may be misleading. Under the climatic conditions normally experienced in this area, namely a relatively low, erratic rainfall pattern, it is expected that the widest row spacing combined with the lowest seeding rate and a thin-stemmed, narrow-leafed cultivar would result in the highest dry-matter yield.

O-Gl.142/3: PLANTING DATE AND CULTIVAR EXPERIMENT WITH VARIOUS ANNUAL FORAGE SORGHUM HYBRIDS. 1974-1977

C. Engelbrecht and H.L.J. Potgieter

An experiment with various annual forage sorghum hybrids was conducted under dryland conditions on a Hutton Shorrocks soil at Glen with the object of determining the latest, as well as the optimum planting date and its effect on total dry-matter yield per season.

The experiment was planted as a 9 x 3 factorial in a randomised block design with 3 replications. The cultivars tested were categorically classified into thick-stemmed, medium-thick-stemmed and thin-stemmed types. The planting dates were late-October (early), mid-December (intermediate) and late January (late). The sorghums were planted in rows 800 mm apart with a presswheel type of planter at a fixed rate of 6 kg seed per hectare. All cultivars were cut in the flowering stage.

In all cases the early planting date resulted in significantly higher dry-matter yields than the intermediate planting date, which in turn resulted in significantly higher yields than the late planting date.

As regards cultivars, it was found that in the case of the early planting date, thick-stemmed, long-season cultivars (Sorghum 944 and Lindsey 92 F) significantly outyielded the medium thick-stemmed cultivars (Lindsey 77 F, Sordan, Kow Kandy) and thin-stemmed cultivars (Trudan II, Hidan). In the case of the intermediate planting date however, the thick-stemmed, long-season cultivar Sorghum 944 was significantly outyielded by Sordan, a medium-thick-stemmed cultivar.

These results indicate that, in the central O.F.S. with its limited rainfall and relatively short growing season, thin-stemmed and certain medium-thick-stemmed cultivars should be preferred on account of their better haymaking qualities and more rapid recovery after cutting. Thick stems appear to be correlated with a long growing season and *vice versa*.

It was also found that some cultivars, although being planted in late January, still yielded as much as 2 tons of dry matter per hectare which can make a significant contribution to fodder production in this region.

DROUGHT RESISTANCE

K-Vl.12/2: PROPAGATION OF DROUGHT-RESISTANT FODDER CROPS IN THE JANSENVILLE EXTENSION WARD. 1973-1977

I. du T. van der Merwe

The object of this project was to test different drought-resistant fodder crops and to acquaint farmers with their value.

Of the saltbush varieties, oldman saltbush (*Atriplex nummularia*) performed the best in respect of vitality, production and palatability, followed by *Atriplex brewerrii A. canescens.* and *A. lentiformis* which were eaten by stock only after most of the other palatable material growing between the plants had been grazed. *Kochia brevifolia* was the last to be taken by stock. Where oldman saltbush and spineless cactus (*Opuntia* spp.) were cultivated in the same plantation it was generally found that because of a difference in palatability, stock over-utilised the cactus and under-utilised the saltbush. *Opuntia robusta* appeared to be the strongest and most palatable grower with the least vulnerability to Cochineal infection. Application of 85% wettable Carboryl powder without wettable gluten (Savimol) will combat Cochineal (*Dactylopius* spp.) at any time of the year. Oldman saltbush is an excellent reclamation plant and can be sown practically anywhere in the veld, watercourses and feeding paddocks. The best time of the year for sowing is from March to August at the rate of 8 kg of seed per hectare. American aloe (*Agave americana*) is an excellent feed during droughts and its propagation is strongly recommended.

K-Gf.98/4: SELECTION AND BREEDING OF DROUGHT-RESISTANT FORAGE CROPS FOR THE KAROO REGION: SITOGENETIC INVESTIGATION OF THE MOST IMPORTANT OPUNTIA CULTIVARS. 1966-1977

G.C. de Kock

Techniques to determine the chromosome numbers of the root tips of the *Opuntia* spp were investigated and as a result the somatic chromosome numbers of the most important spineless cactus cultivars have been determined. It was found that the blue-leafed spineless cactus cultivars have 44 chromosomes per somatic cell while the green-leafed cultivars have 99 chromosomes per somatic cell. This difference can explain the difficulty in obtaining crosses between the two groups.

The development of a technique to obtain preparations from the root tips, pollen or seedbuds suitable for the study of the chromosome morphology was not successful on account of a tendency of the chromosomes to granulate and be sticky.

K-Kn.2/1: DROUGHT-RESISTANT FORAGE CROPS FOR THE NORTH-WESTERN DISTRICTS OF THE KAROO REGION: INTRODUCTION STUDIES. 1964-1977

G.C. de Kock

The adaptability of drought-resistant fodder crops such as spineless cactus and saltbush species (*Atriplex nummularia, A. canescens, A. lentiformis, A. brewerii*) was studied at Carnarvon Research Station and on farms in the districts of Laingsburg, Beaufort-West, Fraserburg, Calvinia, Kenhardt and Pofadder.

It was found that spineless cactus should be irrigated three times per year for optimum production. For best results these irrigations should preferably be given during the period August to January.

The occurrence of the prickly pear moth, *Cactoblastis cactorum* causes considerable damage and losses in plantations and should be controlled chemically. Due to the rapid increase in the price of chemical products, however, the feasibility of such a method of insect control is questionable.

Drought-resistant shrubs, especially the saltbushes mentioned above can be successfully propagated and utilised, especially for summer grazing, in the districts of the north-western Karoo and the establishment of plantations of these shrubs is strongly recommended.

K-Kn.2/2: DROUGHT-RESISTANT FODDER CROPS FOR THE NORTH-WESTERN DISTRICTS OF THE KAROO REGION: IRRIGATION REQUIREMENT OF PRICKLY PEARS. 1964-1977

G.C. de Kock

The fodder production of four spineless cactus cultivars (Robusts, Chico, Monterey and Fusicaulis) was determined at the Carnarvon Experiment Station under different irrigation treatments, *viz.* no irrigation, one irrigation in September, one irrigaiton each in September and November, one irrigation each in September, November and January and one irrigation each in September, November, January and March. With each irrigation 75 mm water was applied.

It was found that the spineless cactus cultivar Robusta produced the highest yield of green material and dry material. An average of 104,05 tons of green material (8,72 tons of dry material) was produced each 3 seasons. Two 75 mm irrigations per season, one in September and one in November, resulted in the best use of irrigation water.

FERTILIZERS

O.Gl.142/2: FERTILIZATION STUDIES WITH ANNUAL FORAGE SORGHUMS. 1974-1977

C. Engelbrecht and H.L.J. Potgieter

An experiment with various annual forage sorghum hybrids was conducted under dry-land conditions on a Hutton Shorrocks soil at Glen with the object of establishing a standard for fertilization as well as investigating the effect of varying levels of fertilization on the yield of annual forage sorghums on dryland in the central Orange Free State. The experiment was planted as a 3 x 3 x 3 x 2 factorial block design with 3 replications.

The cultivars tested were Trudan II (thin-stemmed type), Lindsey 77F (medium-thick-stemmed type), and Haygrazer (thick-stemmed type). Three levels of N-fertilisation (0 kg N/ha, 20 kg N/ha and 40 kg N/ha), two levels of P-fertilisation (13 kg P/ha and 26 kg P/ha), and three cutting treatments (young stage, flowering stage and soft-dough stage) were applied.

The sorghums were planted in 800 mm rows with a commercial presswheel-type of wheat planter at a fixed rate of 4 kg seed per hectare.

It was found that cutting in the flowering stage and the soft-dough stage resulted in significantly higher dry-matter yields than did cutting in the young stage.

As regards N-fertilisation, the results have shown that although 20 kg N per hectare as well as 40 kg N per hectare resulted in significantly higher dry-matter yields over 0 kg N per hectare, the level of 40 kg N per hectare did not result in yields significantly higher than those obtained with 20 kg N per hectare.

This experiment was carried out under abnormally high rainfall conditions for the central Orange Free State. Thus, under the conditions normally experienced in this area, namely a relatively low and poorly distributed rainfall, it seems that 20 kg N/ha and 13 kg kg P/ha may be regarded as a realistic fertilizer recommendation, provided the P-status of the soil is at a satisfactory level.

TRITICALE

(See "Summaries of Thesis" on p. 119)

GROUNDNUTS

FERTILIZERS

T-T.14(Co-op): NUTRIENT ELEMENT SUPPLY TO GROUNDNUTS IN THE WATERBERG. 1962-1968

J.J. van der Merwe

Groundnuts are one of the main crops grown on sandy soils in the Waterberg sand area. The object of the trial was to determine whether there was a deficiency of certain nutrient elements and what their influence was on groundnut production.

A subtractive experiment in a randomized block design employing four replicates was used to determine the response to P, K, Zn, Cu, Mn, Fe, B, Mo, Cl, S, Ca and and Mg. The cultivar Natal Common was planted using an espacement of 920 m x 70 mm on a Longlands form of the Vaalsand soil series over a period of 7 years.

Due to drought and other factors the results were so variable that no definite conclusions could be drawn.

GERMINATION

O-Gl.148/1: EFFECT OF GERMINATION TEMPERATURES ON SEEDLING GROWTH OF GROUNDNUTS. 1976-1977

J. Dreyer

A temperature investigation was carried out in the growth chambers at the University of the Orange Free State using groundnuts (cultivar Sellie) as a trial crop. Constant temperature levels from 10 °C, at 5 °C intervals rising to 35 °C, were used. Three planting depths *viz.* 40;80 and 120 mm were used. Top soil from Vaalharts was used without fertiliser in 5-litre plastic pots. Because flowering begins after 20 days at 25-30 °C, growth was studied during the first 20 days since this period represents the only true vegetative stage. A relative humidity of 40% and a day-length of 12 hours at a strength of one third sunlight was used throughout.

Though the results were very variable, a considerable amount of basic information was acquired whilst much practical study into techniques was carried out with a view to reducing future problems.

No growth was recorded at 10 °C whilst only a certain amount of development was shown at 15 °C. At 20 °C plants developed normally but very slowly. A constant temperature of 25 °C produced growth similar to the normal plant development obtained under field conditions. Variability in the most important measurements was less at 25 °C than at all the other temperatures.

Growth differences at temperatures between 20 °C and 25 °C were much greater than those at between 25 °C and 30 °C or even between 30 °C and 35 °C.

Planting depths showed clear differences in all cases in favour of the shallower plantings. It would seem that the optimum planting depth lies between 40 and 80 mm.

Various growth-components were measured with the hope of finding an easily recognisable unit for expressing growth. These included root mass, root length, leaf areas, petiole length, inter-leaf segment lengths, internode length and total tap-root lengths.

The only practical growth-component measurement was leaf area. This characteristic combines growth with vigour.

LUCERNE

BREEDING

K-Gf.33: A STUDY OF LUCERNE POPULATIONS IN DIFFERENT ENVIRONMENTS. 1958-1977

G.C. de Kock

Lucerne-seed samples from different districts and fields were studied in order to identify superior stands with regard to yield and disease resistance and for the selection of breeding material.

It was found that although there were differences between districts and between stands in the same district, these differences were not significant as far as yield and disease resistance were concerned.

Bacterial-wilt-resistant plants, which can be used for breeding material, were found in all the seed samples, but no bacterial-wilt-resistant stands as such, were identified.

Lucerne black stem (*Ascochyta imperfecta*) was carried by all seed but its occurrence differed between stands and seasons. There is no treatment which can be recommended as a control measure.

Eelworms (*Meliodogyne* spp and *Ditylinchus dipsaci*) are not spread by lucerne seed.

The germination of lucerne seed in high concentrations of sodium chloride can possibly be used as a method to select superior drought-resistant and alkali-resistant plants.

INSECT PESTS

W-Lv.1: CONTROL OF THE WHITE-FRINGED BEETLE *GRAPHOGNATHUS LEUCOLOMA* BOH. 1956-1966

S.S. Walters

The white-fringed beetle *Graphognathus leucoloma* Boh. (fam. Curculionidae), an introduced pest species, was first reported from Rosebank (Cape) in 1940 and subsequently from Stellenbosch in 1946 (Joubert, 1951), Vredendal in 1949, Koekenaap in 1951, Robertson in 1962, Beaufort West in 1962 and from Upington along the Orange river in 1972.

During the late forties *G. leucoloma* emerged as a serious pest of lucerne and short-term cash crops along the the Olifants river irrigation scheme in the Winter Rainfall Region.

Lucerne fields were identified as the ideal breeding place for this insect and also the primary source of infestation. The most logical and permanent means of control seemed to be to render newly established lucerne fields unsuitable for *G. leucoloma* to breed in, and to keep them thus for the longest possible time.

A field experiment was therefore conducted on infested soil and under simulated conditions of a high infestation pressure (artificial infestation on an annual basis), to test the effectiveness and residual action of HHDN, Dieldrin, Chlordane and DDT against *G. leucoloma*.

HHDN, Dieldrin, Chlordane and DDT at the rate of 3 lbs, 3 lbs, 10lbs and 20 lbs, active material per morgen respectively, were applied at the onset of the trial in June 1956 and repeated after 2, 3, 4 and 5 years always during August. Each treatment was replicated seven times.

Yields of unwilted lucerne were taken from a sub-plot (20 ft x 3 ft) on each replicate, on five occasions, during each season and for four consecutive seasons. Average yields of unwilted lucerne lbs./sub-plot/season in different treatments are presented in Table 1.

Yield entries in Table 1 suggest good initial control of *G. leucoloma* in all treatment programmes tested. The downward trend in yield with time in all treatment x interval combinations however, signifies the absence of a long-term residual efect under conditions of continuous high infestation pressure.

Initial success without a long-term residual effect indicates that even a two-year interval between insecticide treatments was too long for effective control of *G. leucoloma* in lucerne fields. Shortening the interval between repetition of treatments to once a year, with the application timed to coincide with beetle emergence during the first half of December is proposed as an improvement.

G. leucoloma is at present not considered an economic pest along the Olifants river irrigation scheme. In view of the results obtained in the field experiment this seems to be a contradiction, since farmers have to rely on the same insecticides used in the trial.

Seen in retrospect, the success against *G. leucoloma* can at least partly be explained by the following facts: *G. leucoloma* had spread quickly down-river from where it was reported at Vredendal in 1949, infesting and destroying all existing and newly established lucerne fields within a couple of years.

Badly damaged lucerne fields were ploughed under in favour of short-term cash crops. This procedure practically lead to the elimination of the ideal breeding grounds and primary source of infestation of the pest. Having been done simultaneously over the whole area, the process of ploughing, dealt the pest a severe blow.

Most short-term cash crops following on lucerne were severely damaged by larvae of *G. leucoloma*. This forced all farmers, who at this stage were desperately in need of any income, to treat the soil against the pest for each following cash crop and so the progress of *G. leucoloma* was severely hampered.

Cash cropping in itself is not advantageous to the progress of the pest. The frequent tillage applied during cash cropping damages larvae and pupae and exposes them to the elements. In addition no cash crop provides food for the entire period of larval development (9-11 months for *G. leucoloma*). Cash cropping continued for several years before lucerne was re-introduced and when lucerne fields were again established they were thoroughly treated leaving little chance for the insect to regain a foothold.

The presence of a biological factor in the success against *G. leucoloma*, although not investigated cannot be excluded.

TABLE 1 - Average yield of unwilted lucerne lbs./plot (20' x 3') taken during the season, from experimental plots treated with various soil insecticides against *G. leucoloma*.

Insecticides	Treatments repeated every	Average Yield			
		1957/58	1958/59	1959/60	1960/61
1. HHCN	2 years	91,20	81,50	76,64	54,97
2.	3 years	88,40	79,00	66,61	50,14
3.	4 years	91,79	81,80	81,51	55,47
4.	5 years	93,00	78,90	74,30	53,29
5. Dieldrin	2 years	88,50	68,60	78,40	46,56
6.	3 years	92,64	79,00	74,59	53,16
7.	4 years	89,30	75,40	76,87	50,61
8.	5 years	96,09	81,80	81,84	56,21
9. Chlordane	2 years	89,33	82,90	79,13	51,53
10.	3 years	92,09	77,80	80,74	51,10
11.	4 years	85,71	89,50	76,41	48,00
12.	5 years	89,70	79,60	72,54	52,50
13. DDT	2 years	90,31	81,00	76,24	60,61
14.	3 years	77,41	64,50	69,34	57,54
15.	4 years	91,43	78,90	71,29	55,34
16.	5 years	85,29	73,70	68,69	48,07
17. Control		49,31	50,20	54,81	33,81
Average		87,15	76,70	74,12	51,68
L.S.D: P = ,05		14,4746	9,0080	14,1600	11,3933
P = ,01		19,0530	11,9270	18,7500	14,9973

MAIZE

DISEASES

(A)PS.Pr.29/6: ROOT ROT OF MAIZE : EFFECT OF SUBSTRATE ON MICROBIAL ACTIVITY IN AGRICULTURAL SOIL. 1969-1975

E.C. Wehner

The purpose of the study was to establish and maintain an active microbial population which would decrease the activity of soil-borne root pathogens.

Attention was given to aspects such as the effect of inoculum concentration on root-rot of maize; the fungistatic activity of the rhizosphere soils of various plants; the effect of applications of maize hay on the occurrence of root-rot, and the effect of certain fertilizers on root-rot of maize.

No consistent results were obtained and there were indications that the amount of root-rot obtained could not be correlated with the concentration of the initial fungus inoculum. The fungistatic activity in the rhizosphere of young maize plants appeared to be lower than in the case of onions and soybeans.

No consistent effect was obtained with the application of organic matter and applications of fertilizers such as superphosphate, urea and 2:3:2 tended to increase the incidence of root-rot. However, plant growth was stimulated to such an extent by the fertilizers that no adverse effects were noticeable.

The problem studied was a complicated one and in most cases the results were not reproducible and should be interpreted with care.

ESPACEMENT

T-Tw.16: ESPACEMENT FOR THE OPTIMUM MAIZE POPULATION. 1962-1967

J.J. van der Merwe and H.H. Fischer

The object of this project was to investigate the influence of spacing within and between rows and also the influence of different inter-row cultivation practices on maize. Previous investigations conducted at the Towoomba Research Station have indicated that 24 000 plants per hectare is the optimum plant population for maize.

The three spacing treatments used were 910 mm x 910 mm with two plants per hill, 910 mm x 460 mm with one plant per hill and 2130 mm x 200 mm with one plant per hill. These spacings produced plant populations of 24 000 plants per hectare. Hand-hoeing throughout the growth season was also compared with tine-cultivation followed by hand-hoeing when the height of the maize prevented further cultivation. The wide rows were tine-cultivated in the early stages and thereafter harrowed with an offset disc between the rows and hand-hoed in the rows.

A 3 x 2 factorial arrangement was used in a randomized block design with four replicates. Net plot size was 18,3 m x 4,6 m except in the case of wide rows when the harvested area was 2,1 m wide. The experiment was carried out on two soil series namely, Shorrocks and Arcadia, at the Towoomba Research Station near Warmbaths. The PP x K64r hybrid was planted after the experiment had been fertilized with 159 kg/ha ammonium sulphate and 212 kg/ha superphosphate.

Except for the 1966/67 season when yields were much higher, no significant differences attributable to spacing or cultivation method were recorded. In 1966/67 the narrow rows significantly outyielded the wide rows on the Shorrocks series and a similar but non-significant trend was observed on the Arcadia series. Severe drought resulted in low yields being produced in the other years.

FERTILIZERS

O-Gl.71: EFFECT OF FERTILIZATION AND INCORPORATION OF STOVER ON MAIZE YIELDS. 1959-1976

J. Dreyer and C. Engelbrecht

The object of the experiment was to determine the effect of different levels of N and P fertilization, as well as that of different methods of treating the crop residues (stover), on the yields of maize under dryland conditions at Glen.

Treatments were as follows:

N-fertilization:	Nil and 32 kg N/ha annually
P-fertilization:	Nil and 17,5 kg P/ha applied annually; 35 kg P/ha applied bi-annually and 70 kg P/ha applied every four years.
Stover:	Situation with stover removed compared with stover ploughed back into the soil after harvesting the grain.

Over a period of 16 years the application of nitrogen (N) did not result in any worthwhile increase in grain yield of maize, but annual application of phosphorus (P) at a rate of 17,5 kg P per hectare resulted in a grain yield increase of 18 per cent above the nil-treatment.

Although the results of this experiment do not show any advantageous effect of the incorporation of stover on the grain yield, this practice is nevertheless advantageous from the point of view of the physical condition and biological properties of the soil.

GROWTH PREDICTIONS

N-Ce.104/2: GROWTH STUDIES ON MAIZE IN THE NATAL MIDLANDS: UTILIZATION OF RADIANT ENERGY BY CANOPIES OF DIFFERENT AGE AND PLANT DENSITY. 1969-1973

H.W. Kaiser and J.M. de Jager

(See summary of Ph.D. thesis by H.W. Kaiser on p.112)

NUTRITIONAL VALUE

H-Ps.232/11: ENSILING AND SILAGE FEEDING: A COMPARISON BETWEEN SILAGE, STOVER AND RIPE MAIZE PLANTS. 1973-1974

H.J. van der Merwe and M. von La Chevallerie

Equivalent numbers of rows from a uniform block of maize were respectively ensiled, stooked (for stover production) and left to ripen on the land. Stooking and ensiling were simultaneously done using plants that at the time contained 35% dry matter. Maize plants were also chemically analysed at this stage.

The stover and the standing mealies dried and ripened respectively within 10 to 12 weeks following stooking and ensiling. Dry-matter losses for ensiling were calculated by measuring the mass of all in-going and out-going material at the silo. The dried stover and ripened mealie plants were ground with the aid of a hammermill fitted with a 30 mm sieve and were then stored in bags.

Apart from the agronomic production study a metabolism study with sheep and a production study with steers were also carried out. Steers were subjected to one of three treatments and were fed either silage, stover or ripened plans on an *ad lib.* basis. A protein supplement consisting of 100 parts mealie meal, 75 parts groundnut-oilcake meal, 25 parts fish meal and 10 parts urea was provided in addition at the daily rate of 1 kg/steer.

Note was also taken of the influence of stage of maturity of mealie plants at 23,5%, 31,85%, 40,32% and 64,79% dry-matter content on total yield and chemical composition. The *in vitro* digestibility of stover (stooked at a dry-matter content of 35%) was also determined.

Table 1 summarizes the average chemical composition of and dry-matter losses in silage, stover and ripened maize plants. The highest loss in dry matter was shown by the ripened plants while silage showed the smallest loss in originally available dry matter. There was a tendency towards a lower crude protein, ash and ether extract content for ripened mealie plants. An apparent breakdown of true protein to non-protein nitrogen occurred during ensiling. No marked differences occurred in the chemical composition of the different forms.

Table 2 summarises the results obtained from the intake and metabolism studies conducted with sheep. While silage was responsible for the lowest intake and stover for the highest intake of dry matter, the highest intake of total digestible nutrients (TDN) and thus of digestible energy obtained, was with silage. Nitrogen retention was significantly lower ($P<0,05$) for the ripened plants compared to silage and stover. No significant differences in the energy balance of sheep occurred with any of the three treatment groups.

Table 3 summarises the results of the production study with steers. The most pronounced response in

TABLE 1 - Dry-matter losses and chemical composition (dry basis) of silage, stover and ripe maize plants

	Original plants	Silage	Stover	Ripe maize plants
Dry-matter losses (%)	-	8,63	13,33	34,90
Chemical composition:				
Crude protein (%)	9,55	9,50	9,54	8,47
True protein (%)	7,41	6,31	7,53	6,81
Non-protein nitrogen (%)	0,35	0,51	0,32	0,27
Ash (%)	5,16	6,04	6,04	4,91
Ether extract (%)	2,42	2,46	2,14	1,88
Crude fibre (%)	21,28	23,21	22,85	23,75
Cellulose (%)	27,37	27,20	27,12	28,49
Hemicellulose (%)	25,01	24,70	26,76	25,06
Lignin (%)	3,93	3,93	3,76	4,02
Nitrogen-free extract (%)	61,61	58,80	59,45	61,00
Sugar (%)	6,84	1,14	4,09	3,14
Gross energy (MJ/kg)	18,36	17,95	17,97	17,93

TABLE 2 - Feeding value of silage, stover and ripe maize plants

	Silage	Stover	Ripe maize plants
Dry-matter intake:			
Intake study (kg/day)	1,36	1,65	1,57
Metabolism study (kg/day)	1,23	1,46	1,25
Apparent coefficients of digestibility:			
Dry-matter (*in vitro*) (%)	64,20	58,99	60,14
Dry-matter (*in vivo*) (%)	65,35	59,91	59,77
Crude fibre (%)	64,96	62,27	58,93
Ether extract (%)	82,27	82,14	75,76
Crude protein (%)	48,99	42,65	36,59
Nitrogen-free extract (%)	71,81	64,83	66,02
Organic matter (%)	68,02	61,86	62,56
Gross energy (%)	66,12	60,04	59,40
Total digestible nutrients (TDN)	66,75	60,67	60,68
Digestible energy (MJ/kg)	11,86	10,80	10,65
Nitrogen retention (g/day)	3,69	3,95	0,49
Energy retention (MJ/day)	14,17	15,36	12,86

live mass gain occurred on silage notwithstanding the opposing tendency in dry-matter intake. Mass gains of the steers seemed to have been influenced by temperature but the animals fed silage reacted more favourably compared to those fed stover and ripened plants. Feeding of silage resulted in significantly ($P<0,01$) greater carcass-masses which were the result both of higher mass gains and higher dressing percentages of such steers. The higher mass gains and increased carcass-masses of silage-fed steers resulted in an expected better marbling score, bigger eye-muscle area, increased fat covering and overall better carcass grading.

Data on the influence of the stage of maturity on the dry-matter yield and *in-vitro* digestibility of stover are summarised in Table 4. Stover cut at 32% dry-matter content (hard-dough stage) showed the highest dry-matter yield. A tendency existed for the crude protein, true protein and ether-extract content to increase with physiological advancement towards the hard-dough stage. The ash content of stover decreased with increasing plant maturity. Cutting at 24% dry-matter content resulted in a higher fibre content than did cutting at later stages of maturity. Nitrogen-free extract of mealie plants on the other hand had the lowest dry-matter content *viz*. 24%. *In-vitro* dry-matter digestibility was not affected by advancement in physiological age of the maize plant.

The results indicate that silage incurs the lowest losses in dry-matter yield, while simultaneously providing the best in respect of digestibility, TDN, mass gain, dressing percentage, produced carcass mass and gross income. The most important factor for the producer to consider in terms of biological and economic efficiency when circumstances force him to produce maize stover, would be when to cut in order to obtain maximum dry-matter yield. The hard-dough stage clearly seems to be the answer.

TABLE 3 - Effect of silage, stover and ripe maize plants on intake, gain and carcass characteristics of steers

	Silage	Stover	Ripe maize plants
Initial mass (kg)	207,0	207,1	207,1
Final mass (kg)	418,1	382,5	369,9
Dry-matter intake (kg/day)	13,43	14,09	13,12
Daily gain (kg)	0,95	0,79	0,74
Carcass mass (kg)	224,6	189,2	181,2
Dressing (%)	53,6	49,9	49,9
Fat thickness (cm)	0,50	0,21	0,27
Marbling (out of 5 points)	1,60	0,35	0,50
Carcass grade (out of 20 points)	17,9	9,8	11,9
Length of carcass (cm)	141,6	141,5	136,3
Rib-eye area (cm²)	59,9	51,6	58,4
Total income/steer (R-c)	231,37	159,13	164,47

TABLE 4 - Dry-matter yield, chemical composition and *in-vitro* digestibility of stover cut at different stages of maturity

	Milk to early-dough	Early hard-dough to hard-dough	Physiologically ripe	Ripe
Dry-matter (%)	23,59	31,58	49,32	64,79
Dry-matter yield (kg/ha)	2779	3731	3416	2898
Chemical composition:				
Crude protein (%)	8,65	9,29	8,23	8,74
True protein (%)	6,25	6,94	6,69	6,38
Non-protein nitrogen (%)	0,39	0,38	0,36	0,38
Ash (%)	5,66	5,22	4,53	4,31
Ether extract (%)	1,15	2,15	2,32	1,91
Crude fibre (%)	30,10	20,85	21,53	23,13
Cellulose (%)	32,37	25,23	23,45	22,80
Hemicellulose (%)	27,40	24,35	22,00	22,39
Lignin (%)	3,77	3,31	3,48	3,26
Nitrogen-free extract (%)	53,69	62,35	62,67	61,22
Sugar (%)	1,54	4,00	3,73	5,23
Gross energy (MJ/kg)	17,24	17,61	18,16	17,86
In-vitro digestibility:				
Dry-matter (%)	68,18	71,50	71,32	71,59

POTATOES

CULTIVARS

N-Ce.116: EVALUATION OF POTATO VARIETIES FOR THE NATAL REGION. 1968/77

B.W. Young

The origins of this project lay in the breeding program (A)PS-Pr 1, the first selections from which were sent to Cedara Experiment Station in 1955 for comparative trials. Since then local and overseas lines were planted annually in evaluation trials. A wealth of information on the agronomic and disease-reaction properties of these potato lines was recorded. Their performance at different seasons, in different areas, and even under plastic mulch for some of the cultivars, was followed.

The decisions to release selected lines as commercial cultivars were partly based on the evaluations of selections growing under Natal conditions. After 6 seasons BP1 became the most popular cultivar in Natal Region , but a further 15 years elapsed before it became the variety with most seed potatoes produced in South Africa in a single year. Vanderplank is the third most popular cultivar after BP1, followed by the old Scotch variety Up-to-date which is, however,not widely grown under Natal conditions. The highest-yielding cultivar was Sackfiller, intended especially for autumn planting, but its full potential like that of a number of others, has yet to be realised.

Some cultivars are being used for purposes other than those for which they were originally released. For example, Cedara was given out as a cultivar suitable for late planting, but it found most favour in winter lands under irrigation. Others were released but soon fell from favour because of inherent disadvantages not apparent at the time of commercial introduction. Due to susceptibility to hail damage and to virus X, 833/7 disappeared from seed production lands. Cedara is still included in the current national breeding and selection projects for evaluation purposes.

DISEASES

N-Ce.125/2: DISORDERS OF SEED-POTATO TUBERS: BLACK SCURF AND STEM CANKER CAUSED BY *RHIZOCTONIA SOLANI*. 1973-1977

B.W. Young

Black scurf is found to a varying degree on the tubers of most potato crops. A series of field experiments was carried out in different soil types, under both dryland conditions and irrigation, and at different planting times. Various conclusions were drawn which are summarised below.

It seemed evident that the causal fungus can be carried on tubers in a symptomless fashion. The absence of sclerotia does not preclude the mycelium from being present on tuber surfaces, but the incidence of canker and scurf is higher with medium or heavy infection of tubers in the form of sclerotia.

The use of untreated infected tubers usually has little or no detrimental effect on total yield of the resultant crop but if conditions occur which delay the quick germination of a planting this will enhance the chances of a reduced plant stand.

In the experiments conducted, various land-preparation operations had no effect on final black scurf incidence, or even on the amount of stem canker during crop growth. These operations included the time of year in which land was initially broken up in the year before planting, the presence or absence of undecompsed organic residues from the previous grass cover, and whether a land was limed or not. The addition of a nitrogenous fertiliser to assist decomposition before planting also seemed to have no influence on the final expression of disease.

The unavailability of organo-mercurials for use as seed treatment has obviously affected the *R. solani* disease control situation. Experiments had confirmed that use of an effective seed-treatment chemical was the most effective single treatment to reduce the amount of stem canker. The use of quintozene in the soil also reduced the extent of stem canker, but not to the same degree. The most effective of the replacement chemicals found will not be marketed, and the search for an effective seed dressing, either as dip or dust, must continue. None of the commercially available compounds tested, was found sufficiently effective against the disease.

Applied as a soil treatment, the compound quintozene almost invariably had a beneficial effect in reducing the incidence of black surf on the resulting crop. Its use in the experiments often had the greatest influence on disease reduction. In very wet soil conditions, and when the chemical was not well incorporated into the plant furrows, the effect of this treatment was reduced or nullified. In experiments using up to 50 kg of the 75% product per hectare placed in the rows, there was no significant crop delay or effect on yield.

The crop-growing conditions appeared to exert some effect on disease incidence and while mild growing conditions reduced infection, this was enhanced when there was crop stress such as dry or very wet soils, or hail damage.

N-Ce.125/4: DISORDERS OF SEED-POTATO TUBERS: COMMON SCAB CAUSED BY *STREPTOMYCES SCABIES*. 1973-1977

B.W. Young

Various culture media were used to establish the best method for isolating *S. scabies* from infected material. A growth medium containing tyrosine which is broken down to melanin by the organism, the resulting dark pigmentation revealing its presence, was found to be the most satisfactory. However, the quick overgrowth of colonies by contaminating bacteria proved an obstacle in isolating the organism.

Pot and field trials to determine to what extent common scab can be controlled by maintenance of high soil-moisture levels at the early tuber bulking stage, gave disappointing results. There was a trend towards suppression of scab by high levels of soil moisture, but positive results were masked by rainfall in the Cedara trials. In general it would appear that the high evaporation rates prevailing under South African conditions militate against this possible method of scab control.

Treatment of scabbed seed, specifically with the fungicide mancozeb, significantly reduced the danger of transmitting the disease to soils where the organism was not yet established. It should be recommended in cases where seed producers have experienced scab infection in their potato crops, even though tubers are sorted for those with no visible scab symptoms.

The use of quintozene significantly reduces scab incidence in the resulting crop when the chemical is well incorporated into the soil at the time of application. Of all control methods used in the experiments this measure gave the most significant response for scab reduction.

The project will be replaced by a national programme based initially on these results.

N-Pm.16/3: THE EPIDEMIOLOGY OF POTATO LATE BLIGHT IN THE NATAL REGION. 1959-1977

B.W. Young

The project had as aim to monitor recorded weather data and observed outbreaks of late blight disease in potato crops in different parts of the Region in order to correlate weather conditions with blight outbreak and spread. In this way a late blight forecasting system for potatoes could be devised.

The formulated criteria were tested in ghost forecasts for some seasons and the first actual warnings were broadcast and published in the 1964/65 season. In the following summer season the blight forecasts were divided according to three areas in which blight was expected to occur successively.

It was concluded that inoculum of the causal fungus was obtained only in exceptional cases through the planting of blight-infected tubers. Inoculum for the early summer crops is almost entirely derived from winter plantings of potatoes in the irrigated river valleys. The disease spreads to the normal September plantings of table and seed-potato crops, and finally moves to the later-planted summer crops and the crops growing in the colder soils of East Griqualand, Underberg area and areas near the Drakensberg.

The system is fairly unique in that it is the only one known in which warnings are based on the meteorological data from one station — Cedara. Once the initial warning of blight outbreak in an area has been issued, farmers are expected to initiate and continue with a regular spray programme.

For some years no modifications have been needed to this epidemiology programme and the forecasting service will continue in the future. However, this project will be replaced by an attempt to devise a national blight forecasting programme, or the ultimate replacement of broadcast warnings by electronic equipment which might enable individual potato growers to judge when the initial spray is necessary and the frequency of subsequent spray applications.

WHEAT

CULTIVARS

K-Gf.76: WHEAT CULTIVAR EXPERIMENT. 1962-1977

G.C. de Kock and B.A. Lotter

The yield and adaptability of different wheat cultivars with different planting dates under irrigation, were studied at Grootfontein College of Agriculture near Middelburg in the Cape Province as representative of the Cape Midlands plateau. The trial was repeated at the Cradock Experiment Farm as representative of the Fish River irrigation areas and co-operatively at Graaff-Reinet as representative of the Upper Sundays River irrigation areas.

The cultivars Zambesi, Gamenya and Tosca were the best regarding yield and stability. The cultivar Scheepers 69 is recommended for early plantins, i.e. before 15 June.

A forecast regarding planting date cannot be made for the area as first mentioned the optimum planting date varies from year to year. In general, however, the June plantings did the best. In the Fish and Sundays River Valleys the June plantings produced the best results throughout.

The production potential for durum wheat in the Fish River Valley was studied and this area was found to have a high potential. Seed was multiplied from the best durum line D6647 (since released as cultivar Norda) to develop this area for durum wheat production.

Fruit

APPLES

BIOCHEMISTRY

(S)WP.172/9: BITTER PIT IN APPLES : EFFECT OF GROWTH REGULATORS ON THE UPTAKE AND DISTRIBUTION OF CALCIUM IN THE APPLE PLANT. 1976-1977

J. Steenkamp

It is now generally accepted that bitter pit is associated with a low calcium status in the apple fruit. Partial control of bitter pit has been achieved by frequent applications of calcium sprays during the growing season. Although this treatment reduces the incidence of bitter pit, many fruits are still affected. It is known that growth regulators having a marked effect on the creation of natural metabolic sinks, may change the nutrient requirement of the plant, the uptake of nutrients and the movement and concentration of mineral nutrients in the plant. Therefore growth regulators such as NAAm, Kinetin, SADH, CEPA, GA_3, and 2,4,5-TP were used at different concentrations to increase the calcium status of the fruit. It was found that NAAm sprays at a concentration of 25 mg/ℓ significantly increased the uptake of calcium-45 in apple seedlings. Where apples were treated with 25 mg/ℓ NAAm plus calcium-45 the uptake of calcium was only significantly higher at 91 days after full bloom. Frequent NAAm and NAAm plus $Ca(NO_3)_2$ sprays, at two-weekly intervals from mid-December until mid-February, reduced the size of the apples to such an extent that 80% of the crop could not be exported. For this reason, the use of NAAm sprays on apples is limited.

During this investigation it was found that the wetting agent, Agral-90 decreased the uptake of calcium-45 in apple seedlings because of a reduction in transpiration rate. It has no effect on the calcium status of the fruit, most probably because of the low transpiration rate of the fruit. Agral-90 could be used as a wetting agent to limit lenticel injury by calcium-nitrate sprays.

(S)WP.172/12: BITTER PIT IN APPLES : INFLUENCE OF RATE OF PRECOOLING ON THE DEVELOPMENT OF BITTER PIT. 1976-1977

G.J. Eksteen

The general concept that cold storage of apples does not influence bitter pit development but merely delays it, was in this investigation proved to be incorrect. Adequate proof was found that the handling methods immediately after harvesting, play a very important role in bitter pit development.

Precooling of Golden Delicious apples within four days after harvesting led to a decrease of approximately 80% in bitter pit development, compared to fruit which was not precooled prior to packing. Bitter pit was further reduced by packing precooled apples in polyethylene bags within the cartons.

Although the reduction of bitter pit in White Winter Pearmain apples was not as marked as in Golden Delicious, rapid precooling prior to packing also proved to be an important bitter pit control measure for this cultivar. Because of the danger of lenticel injury, however, White Winter Pearmain apples should not be packed in polyethylene bags.

Rapid precooling also leads to an overall improvement of the keeping quality of cold-stored apples. This benefit, coupled with bitter pit reduction, stesses the great importance that must be attached to prompt and rapid precooling after harvesting.

Publication:

Eksteen, G.J., Ginsburg, L. & Visagie, T.R., 1977. The role of precooling in the control of bitter pit. *Deciduous Fruit Grower* 27, 19-15.

(S)WP.172/1: BITTER PIT IN APPLES: SPRAY TREATMENTS FOR BITTER PIT. 1968-1976

J.H. Terblanche, W.J. Pienaar and K.H. Gürgen

Field experiments were conducted over six successive seasons in order to establish an efficient spray programme for the control of bitter pit in apples. In these experiments special attention was given to the timing of calcium sprays, wetting agents and other additives, methods of application and the behaviour of calcium applied to the fruit surface. The results obtained have led to the following conclusions:

1. The absence or presence of wetting agents had no influence on the effectiveness of the calcium sprays but the incidence of "calcium spot" was aggravated by the absence of a wetting agent.
2. The addition of DPA (diphenylamine) had no influence on the effectiveness of calcium sprays.
3. Spray applications of Ca-EDTA equivalent to 0,65% and 1,30% calcium nitrate respectively, result in severe leaf scorch and had no effect on the incidence of bitter pit.
4. Calcium sprays applied at the rate of 5 kg of calcium nitrate per 500 litres water during the last month before harvest can result in a superficial blemish which could render the fruit unsuitable for export.
5. Hand-spraying and air-blast spraying were equally effective, provided that the trees are easily penetrable to the spray material and proper coverage of the fruit was achieved. In order to obtain the same level of efficiently throughout the same quantity of spray material per tree should be applied with these two methods. On very dense trees, however, the speed of the air-blast sprayer should be reduced to such an extent that more material is applied per tree with the air-blast sprayer than is normally applied with a thorough hand spraying.
6. Due to the high solubility of calcium nitrate, the applied calcium is easily washed off the fruit surface by rain, overhead irrigation or other sprays. Therefore other sprays or overhead irrigation should not be applied within a week after the application of the calcium spray.
7. Maximum efficiency on Golden Delicious and Starking apples was obtained with sprays of calcium nitrate at the rate of 0,65%, applied at fortnightly intervals from mid-December to mid-January. Additional sprays on these two cultivars, either before mid-December or after mid-January, had very little or no effect. On White Winter Pearmain and Cox's Orange Pippin, maximum efficiency was achieved with four and five sprays respectively.
8. Because of the relationship between the bitter-pit potential (natural intensity of bitter pit) and the residual bitter pit (bitter-pit intensity after application of the most efficient spray programme) this programme can on an average effectively attain a 16% potential. This suggests that in order to eliminate the development of bitter pit by calcium spray applications completely, the bitter-pit potential should be below 16%.

Publications:

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Terblanche, J.H., Pienaar, W.J., Van Niekerk, P.E. Le R. & Dempers, P.J., 1969. Calcium sprays against bitter pit. *Decid. Fruit Grow.* 19, 348-349.

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Truter, W., Pienaar, W.J., Terblanche, J.H. & Gürgen, K.H., 1970. What happens to applied calcium on apples which were sprayed with calcium nitrate for the control of bitter pit? *Decid. Fruit Grow.* 20, 346-348.

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PROCESSING

(S)WP.185/1: UTILISATION OF IONISING RADIATION IN AGRICULTURE: IRRADIATION OF APPLE JUICE. 1971-1977

B.K. Nortje

Clear apple juice was prepared from quantities of approximately 250 kg Golden Delicious apples. The volatile flavouring constituents were separated and concentrated by fractional distillation to yield an organic phase in which the major constituents were identified. The presence of benzaldehyde in apple juice was established for the first time. By irradiation of the flavour concentrate with gamma rays, two constituents were reduced. 2-Hexen-1-al was converted to n-hexanal and 2-hexen-1-ol was converted to n-hexanol. The undesirable odours which developed during the irradiation of the flavour concentrate as well as of the reconstituted juice concentrate (without its volatile substances) could not be separated by fractional distillation and could thus not be identified.

STORAGE

(S)WP-Ks.7: STORAGE OF APPLES. 1950-1972

L. Ginsburg, T.R. Visagie, A.B. Truter,
A.B. Daneel and G.H. de Swardt

The optimum picking dates for the most important South African apple cultivars were experimentally determined. The more immature the stage at which superficial-scald-susceptible apples were harvested, the higher the incidence of superficial scald found on such apples after storage.

Granny Smith apples proved to be the most scald-susceptible cultivar with Golden Delicious being relatively resistant to this disorder. Diphenylamine (DPA) and ethoxyquin, both anti-oxidants, were found to be very effective superficial-scald inhibitors, especially if applied to apples within two weeks from harvesting, DPA being the better of the two. Many methods of application were used but the best method was by effectively wetting the apple with DPA. In South Africa this method is used on a large scale on apples for the local market and has proved of great economic benefit to apple producers.

Other apple storage disorders which were studied included bitter pit, water core, soft scald, black heart, sunburn scald and core-flush. Endeavours were made to find effective ways to minimise the losses caused by these disorders:

It was established that Granny Smith with the slightest sunburn should not be stored for longer than three months. Bitter pit was found to develop on certain apples that had a sound appearance when placed in the cold store. Accelerated ripening of apples was found to lead to bitter pit development within one week from harvesting. This technique has been put to good use by producers when selecting apples from specific orchards for long-term storage. Although post-harvest dips of apples in dilute aqueous solutions of calcium salt reduced bitter pit development, the results were inconsistent and dipping was initially not recommended for commercial usage.

Hydrolysis of urea- and melamine-formaldehyde-based resins which were incorporated in the corrugated cardboard and papier mâché interleaf trays of the first cartons used in the industry in South Africa, resulted in the release of free formaldehyde which caused the development of lenticel spot on the packed apples. A change in the formulation of the wet-strength agents used in the packing material overcame this problem.

Apples picked at the optimum stage of maturity withstood a storage temperature lower than their freezing point for 144 hours without suffering irreversible damage, provided the temperature was subsequently raised gradually by 1,0{5C per day until all the apples were above their freezing point. This knowledge has proved invaluable when dealing with freezing injury of apples in cold stores.

The dimensions, rigidity, ventilation, wood treatments and inner finish of the bulk bin were factors that received detailed investigation before the bin was introduced on a large scale for the handling of apples in the industry. The introduction of the bulk bin has led to more efficient handling and a big drop in the quantity of apples bruised during handling.

Studies which showed that immersion of apples in water did not harm their keeping-quality led to the introduction of hydro-handling of apples in South Africa. This has resulted in a reduction in bruise injury during handling in packsheds.

Temperatures 4 °C higher than those recommended were found in apples stored in most commercial fruit cold stores. Ineffective air circulation was found to be the fault and the introduction of false ceilings did much to rectify this weakness.

Controlled-atmosphere (CA) storage tests established that Golden Delicious, Starking and Granny Smith apples require 3,0% oxygen, while the carbon dioxide requirement was 5,0%, 3,0% and 0,0%

respectively, with nitrogen making up the gas mixture to 100%. Golden Delicious apples derived the greatest benefit from CA storage while the White Winter Pearmain cultivar could not tolerate this type of storage.

(S)WP.209/2: COLD-STORAGE DISORDERS OF FRUIT, VEGETABLES AND FLOWERS: A COMMERCIAL METHOD TO CONTROL SUPERFICIAL SCALD ON APPLES WITH ANTI-OXIDANT EMULSIONS. 1972-1977

G.J. Eksteen

Superficial scald on apples causes serious losses in the apple industry if the anti-scald chemical, diphenylamine (DPA) is not carefully and correctly applied. A simple method of determining the DPA concentration on the farm and which enables the producer to keep the DPA concentration in the dipping solution at the optimum concentration, was developed and is now also being used in other countries as well.

Because imported DPA formulations are expensive, a local formulation containing chemically pure DPA and a pharmaceutical mineral oil was developed and evaluated. A chemical firm is now investigating the possibility of local manufactured DPA-impregnated fruit. Another outcome of this study is that wrappers which are as effective as the imported ones are also now being manufactured locally.

Attention was also given to the application of DPA solutions to apples in bulk bins. A variation of up to 36% in the DPA content of apples from different positions in the bin was recorded which meant either an excessive or a too low DPA content. A drench system, developed by a local manufacturer and tested by the FFTRI, gave a very even distribution of the DPA solution both throughout the bin and also within the apples.

Ethoxyquin (EQ), another anti-oxidant, was also evaluated but was found to be less effective than DPA on Starking and Granny Smith apples. EQ is, however, recommended for Golden Delicious apples stored under controlled-atmosphere conditions or packed in polyethylene bags (DPA tends to discolour these apples). Neither the EQ solution nor the treated apples should be exposed to direct sunlight.

Publications

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CITRUS

COLD STORAGE

(S)N.24/8: THE COLD STORAGE OF CITRUS FRUITS: INVESTIGATION ON THE OCCURRENCE OF RIND PITTING. 1974-1977

S.F. du Plessis

The object of this investigation was, firstly to survey the occurrence of rind pitting in the different citrus-producing areas, secondly to determine which factors favour the incidence of rind pitting and thirdly, to define the symptoms by means of a microscopic investigation of the cell structure of the rind.

From the start of the investigation it was clear that rind pitting is a post-harvest problem and is therefore only discovered during inspection at the ports.

Port rejections due to rind pitting increased from 0,04% of the total citrus crop exported during 1971 to 1,97% in 1974 and decreased again to 0,01% in the 1977 season. Tomangos were the most susceptible to rind pitting, followed by Proteas, Valencias and Navels, with grapefruit and lemons the least affected.

Rind pitting is closely related to oleocellosis and a clear-cut difference does not always exist. This was confirmed by microscopic investigation which revealed that both diseases are caused in the same way. In the case of oleocellosis an oil gland near the surface of the rind is ruptured and the oil thus released to the surface causes the superficial blemish. In rind pitting the rupture of the oil gland occurs internally and oil is released intercellularly in the neighbouring parenchymatic flavedo tissue. This causes plasmolysis, the collapse of the cells and the typical "pitting" on the rind surface. It was found that rind pitting was often associated with careless farming practices viz. rough handling, harvesting when the fruit is wet and long-distance road transport. Major fruit rejections for rind pitting occurred from packhouses with a poor record regarding other factors such as injuries, blemishes and oleocellosis.

The severity of oleocellosis and rind pitting varies from one season to the next and even within a particular season. It was found that night temperatures below 5 °C (i.e. handling of cold fruit) were one of the contributing factors in rind pitting.

The reason for the sensitivity of the fruit skin during some weeks or seasons is unknown. it was thought that among the factors contributing to rind susceptibility to injuries (and thus oleocellosis and rind pitting) are the relative humidity of the air, turgidity of the fruit, minimum temperature and generally poor farming practices.

Preventive measures which were drawn up and distributed to the farmers, included the following: Wet and cold fruit should never be handled, picking should not start before the relative humidity of the air drops to below 70% and trees should be skirted to prevent fruit from accumulating sand. Rough handling during harvesting and transporting to the packhouse should be minimized, and fruit should not be picked within one week after an irrigation or rainfall of more than 20 mm.

Although these preventive measures will not eliminate rind pitting and oleocellosis they should be reduced to a minimum as should also rejections due to injuries.

FRUIT SET

(S)N.108/1: GROWTH REGULATORS AND NAVEL FRUIT SET. 1970-1977

J.H. de Lange

Pollination, girdling and growth regulators were studied as possible means of increasing the yield of navels. This report is mainly concerned with the effect of growth regulators on fruit set, though mention is also made of the girdling experiments. Cross-pollination by hand did increase fruit set but was not a practical proposition. Results were as follows:

1. Applications of GA_3 to flowers increased fruit set whilst 2,4-D had the opposite effect and also resulted in the prevention of stylar abscission. With the concentrations used, IAA, kinetin and ABA did not influence fruit set.
2. When applied direct to flower buds, flowers, pistils after petal drop and on 10 mm-diameter fruitlets, GA_3 increased fruit set in each case.
3. Trunk-injections of GA_3 resulted in rapid translocation of this hormone through the tree and a dramatic accumulation in young leaves. Moderate concentrations of GA_3 were located in pistils and roots. Within six hours after injection a 100-fold increase in gibberellin content was found in young leaves. GA_3 trunk-injections decreased yields drastically in some trials and induced shoot growth with physiologically juvenile characteristics.
4. Spraying of trees with GA_3 and 2,4-D and combinations of these regulators exerted no influence on production
5. Girdling was evaluated in two trials. In one of these, yields were not influenced at all while there was a very strong tendency to increased yields (27% increase) in the other trial in which trees were girdled two weeks after bloom. Girdling of citrus trees should be investigated more thoroughly in South Africa.

A possible explanation for the phenomenon that fruit set is increased by GA_3 applied direct to flowers but not when in the form of a cover spray, is that there is a dramatic mobilisation of GA_3 by young leaves and so, in the second method a much smaller amount of GA_3 effectively reaches the reproductive organs compared with a relatively large amount falling on the vegetative organs.

PROCESSING

(S)WP.196/2: PROCESSING OF CITRUS FRUIT: DETERMINATION OF ORANGE CONTENT OF ORANGE DRINKS. 1971-1977

C.F. Hansmann

During the 1973 and 1974 seasons six orange cultivars on two types of rootstock were processed to a frozen juice concentrate and analysed for formal titre and betaine content. During the 1975 and 1976 seasons Navels and Valencias from different areas, harvested at two stages of maturity, were similarly processed. During the 1976 season a number of additional orange juice samples were also preserved as frozen samples. These samples were analysed for formal titre, betaine and nitrogen content and the individual sugars.

The usefulness of formal titre, betaine and nitrogen content as an index of purity of orange juice is limited by the variability of these compounds. The almost 1:1 ratio of fructose:glucose in all the samples also limits the usefulness of these compounds as an index of purity of orange juice.

(S)WP.196/3: PROCESSING OF CITRUS FRUIT: EVALUATION OF ORANGES FOR PROCESSING. 1972-1977

C.F. Hansmann

During the 1973 and 1974 seasons, juice was prepared from fruit of the cultivars Navel, Hamlin, Shamouti, Tomango, Pineapple and Valencia (Olinda selection) on two types of rootstock. After shipment from Nelspruit to Stellenbosch a juice concentrate was prepared and analysed for sugar and acid after frozen storage. After dilution to 10° Brix the samples were judged by a panel. During both seasons the Valencia samples were judged to be of poorer quality than the other samples. This was undoubtedly a reflection of the high acid content of this cultivar. (Sugar/acid ratio between 6,1 to 1 and 6,4 to 1).

During the 1975 and 1976 seasons, fruit of the cultivars Navel and Valencia were harvested in different areas from those of the previous seasons. These samples were processed and judged similarly. The sugar/acid ratios of the Valencia samples were generally lower than those of the Navel samples. The panel detected a greater number of off-flavoured Navel samples than Valencia samples. The juice prepared from more mature fruit tended to be of a better quality.

ROOTSTOCKS

(S)N.1/3: CITRUS ROOTSTOCK STUDIES: *CITRUS RETICULATA* (TANGERINE) AND OTHER CITRUS TYPES AS ROOTSTOCKS FOR PALMER NAVELS. 1962-1977

L.C. Holtzhausen

Thirty-seven *Citrus reticulata* cultivars and hybrids, as well as two rough lemons, five sweet oranges and the Rangpur lime, were tested as rootstocks for the nucellar Palmer navel. The trees were planted in 1961 in a sandy loam soil at the Citrus and Subtropical Fruit Research Institute, Nelspruit. The experimental design was a randomized block with three replicates and two trees per plot. Statistically significant differences between the different rootstocks were found for yield (all seasons except 1974/75), fruit size (only 1972/73 and 1974/75 seasons), percentage juice (only 1967/68 season), percentage total soluble solids (only 1968/69 and 1975/76 season), percentage acid (only 1967/68 and 1968/69 season), and TSS/Acid ratio (only 1975/76 season).

The best rootstocks for the different characteristics investigated, were found to be the following:

Yield:	Rosehaugh mandarin, Orlando tangelo and Thomas mandarin.
Average fruit mass:	Bombay mandarin and *Japansche* citron.
Percentage juice:	Transvaal loose-skin mandarin and Cleopatra mandarin.
Total soluble solids %:	Citrangor.
Percentage acid:	Minneola tangelo.
TSS/Acid Ratio:	Citrangor, Tankan sweet orange and Rangpur lime.
Index:	Heen Naran mandarin.

SCION STUDIES

(S)N.2/10: FIBRE STRENGTH OF CITRUS FRUITS. 1971-1978

P.J.L. Grobler

This project, to find a practical method of determining the fibre strength of the edible portion of citrus fruit, was undertaken as a result of unfavourable comments from the overseas market on the tough fibre content of South African citrus fruit.

A technique involving the Warner-Brätzler shear, used for quality control in the meat industry, was succesfully applied to determine the fibre strength of citrus fruit segments:

Citrus tissue under test is torn at a constant speed by a shear-type mechanism and the force used is read from a dial scale calibrated in kilograms. The more sohisticated Instron penetrometer apparatus is not suitable for general use in the industry but it can be of great value in the research field.

It was found that:

1. Citrus cultivars differ in fibre strength,
2. Smaller fruit have a more tender fibre at a young stage, than bigger fruit. This tendency decreases with increasing fruit age.
3. The fruit fibre is more tender later in the season.
4. Fibre strengths differ in the different regions and all regions showed a tendency towards more tender fibre later in the season.
5. A positive correlation exists between fibre strength and fruit-seed content. The effect of climate or other external factors on fibre strength was not investigated but it is suggested that it may be possible to control fibre strength by manipulating these factors.
6. The fibre content of fruit grown in the winter rainfall area compares favourably with that of fruit from Mediterranean countries, but fruit from both South African summer rainfall areas and from the U.S.A. has a tougher fibre content.

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GENERAL

DISEASES

(S)WP.208/3: ABOVE-GROUND FUNGUS DISEASES OF DECIDUOUS FRUIT, TABLE GRAPES AND OTHER ALLOCATED PLANTS: SUITABILITY OF DIFFERENT CHEMICAL PRODUCTS AS WOUND SEALERS AND GRAFTING WAXES. 1973-1977

A.C. Thomas, F.N. Matthee and J. Hadlow

From isolations and collection of macroscopic fungal bodies it is apparent that deciduous fruit and vines are attacked by a number of wood-rotting fungi and bacteria. There is, however, a definite selection of host plants by the different parasites. *Eutypa armeniacae* attacks only apricots and vines, and these two hosts are also attacked to a lesser extent by *Polyporus* species. In peaches the main pathogen is *P. hirsutus*, and in apples members of the *P. versicolor adustus* group. *Stereum purpureum*, although it attacks both pome and stone fruit, is not as important as 20 years ago, probably as a result of effective sanitation measures by producers.

Of the different pesticides tested for incorporation into wound sealers, a combination of 8-hydroxiquinoline sulphate and pyrocarbolid (2 methyl-5,6 dihydro-4-H pyram -3-carboxylic acid analide) gave the best results and a combination of 8-hydroxiquinolene sulphate and captafol the second best. These combinations inhibit ascomycete, polyperus and bacterial wound pathogens satisfactorily.

Of the five bitumen-type bases tested, none gave satisfactory results in respect of tenacity and weather resistance. Better results were obtained with polyvinal acrylic emulsions, but although their tenacity was good, they tended to crack after a few months. Excellent results were obtained with steriseal consisting of a homopolimeric polivinal acetate base incorporating captafol and 8-hydroxiquinoline sulphate.It is easy to apply, non-phytotoxic, adheres excellently and does not crack after prolonged exposure to the sun. The only limitation of this product is that it cannot be used as a grafting wax as it has a low viscosity and can therefore penetrate the graft union.

Publications:

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GRANADILLAS

CULTURAL PRACTICES

(S)N.119/3: INCREASING THE ECONOMIC LIFESPAN OF GRANADILLAS: EFFECT OF SHADING, MULCHING AND IRRIGATION PRACTICES. 1973-1977
D.L. Milne, E.A. de Villiers, J.H. Logie,
G.S. Bredell, C.J. Barnard and F.A. Kuhne

The effect of various irrigation cycles on the yield of purple granadillas grafted onto yellow granadilla rootstocks was studied in two trials. Mulching with black plastic mulch and shading with plastic gauze were included as cultural practices.

Nelspruit trial (Loamy sand)

All irrigation treatments gave significantly better yields than the non-irrigated plots, the best results being obtained with irrigation every 14 days though this did not differ significantly from the seven or 28-day cycles. As might be expected, the benefits of irrigation were much greater when combined with methyl bromide soil-fumigation. Irrigation with mulching was significantly better than without mulching whereas mulching without irrigation gave poor results. Shading had no apparent beneficial effect. In general then, there was a favourable interaction between irrigation, fumigation and mulching.

Fumigation of the soil with methyl bromide gave significantly increased yields when compared with DD or no fumigation and appears to justify the additional expense on heavily nematode-infested sandy soils. This response to methyl bromide is probably also due to the wider spectrum of soil pathogens controlled by this fumigant.

Burgershall trial (Red clay-loam)

In this trial, mulching was found to give significantly better yields than no mulching. Mulching was better at all irrigation levels but was best in combination with the seven-day irrigation cycle which, with or without shading, gave a highly significant yield increase over the non-irrigated plants. Irrigation every 28 days was also superior to non-irrigation, and did not differ significantly from the seven-day cycle. Shading did not significantly change the efficacy of the seven-day irrigation.

In this case also there was interaction between fumigation and irrigation. Irrigation at seven days (with or without shading) was significantly more beneficial in combination with fumigation, than without it. However, the DD-fumigated plots did not give an overall significant increase in yields over the non-fumigated plots on this heavy soil which is not as heavily infested with nematodes as the Nelspruit soil.

From the point of view of stem-rot control, both trials were regarded as a success. After 18 months the Nelspruit trial contained only one plant out of 200 with stem-rot, and at Burgershall, over the same period, only two plants out of 128 were infected.

Virus diseases now appear to be a limiting factor in granadilla production and this aspect is receiving attention.

TRELLISING

(S)WP.214: PLANTING AND TRELLISING SYSTEMS FOR GRANADILLAS. 1971-1977
C.W.J. Bester

An experiment was started during 1971 to find the most suitable planting and trellising system for the purple granadilla in the Western Cape. The treatments consisted of:

1. Vertical trellises, 2 m high with plants spaced 2,5 m apart in rows 2,5 m from one another.
2. Vertical trellises as mentioned above with plants spaced 1,5 m apart.
3. Two vertical trellises (i.e. double-row system) 1,5 m apart with plants spaced at 2,5 m.
4. Slanting trellises with plants spaced 2,5 m apart.

Rows were 50 m long and the four treatments, taken as a block, were replicated five times. The plants started to bear during their second year and fruit masses were recorded twice weekly during the harvesting period. A market survey was undertaken to determine the consumption, price and quality requirements of granadillas for the fresh market in the Western Cape. The experiment was terminated after 6 years due to *Phytophthora* infestation. There were no significant differences between yields over four years, although the plants on the slanting and vertical trellises at 1,5 m plant intervals gave the highest yields. Yields of more than 20 tons per hectare were recorded from the third year. Calculations of expenses showed that the vertical trellis with the 1,5 m spacing was the most economical system for this area. Grafting of the purple granadilla on the *Phytophthora*-resistant yellow granadilla is highly recommended.

GRAPES

BREEDING

(S)WP-BD.59/2: THE BREEDING OF NEW TABLE-GRAPE CULTIVARS. 1966-1977

N. Hurter and P.J.L. Ellis

The object of the breeding programme was to develop improved cultivars which *inter alia* would level off the existing production peaks.

Beginning in 1966 several crosses were made between selected parents, and the seedling population resulting from these crosses was evaluated in trial vineyards. A number of promising selections were made and after further evaluation, both at experiment farms and by co-operative growers, one of these selections is now in the process of being released as a new table-grape cultivar. This selection, from a cross between Almeria X Queen of the Vineyard, possesses excellent berry quality, is resistant to berry cracking and rotting and is well adapted to all grape-growing areas, especially the summer-rainfall areas of the Transvaal. A number of other very promising selections are undergoing final evaluation.

Publications:

Hurter, N & Ellis, P.J.L., 1975. The breeding of improved table grape cultivars. *FFTRI Information Bulletin No.* 280.
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Roos, T.J., 1966. Breeding problems of our table grapes. *Decid. Fruit Grow.* 16,96-97.
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CULTIVARS

(S)WP.164/1: SELECTION OF TABLE-GRAPE CULTIVARS AND ROOTSTOCKS: SELECTION OF WALTHAM CROSS. 1966-1977

G.J. Le G. Smit

In the selection programme, 53 out of a total of 922 vines originally selected on 75 farms were evaluated in a statistical experiment on the Bellevue experiment farm. By 1971 the results of three seasons were available and two clones (Nos 22 and 44) proved so promising that they were released to producers. The results obtained since 1971 confirmed the quality of these two clones; they yielded an average annual production of 9,3 kg/vine (3 760 boxes/ha) and 9,4 kg/vine (3 722 boxes/ha) of export-quality grapes respectively, in comparison with the average of 1 200 boxes per hectare for the industry as a whole. During seasons with high incidence of millerandage, such as 1976/77, clone 22 proved better in commercial vineyards than underselected material, and in this regard clone 22 is preferred to clone 44. The best clones have already been subjected to heat therapy for the elimination of viruses.

(S)WP.164/2: SELECTION OF TABLE-GRAPE CULTIVARS AND ROOTSTOCKS: SELECTION OF BARLINKA. 1967-1977

D.C. Uys

After a selection programme involving Barlinka in which 860 vines were initially selected on 85 farms, fifty clones were finally tested in a statistical experiment.

The experiment has now been terminated after data had been collected for eight years. A selected clone (No. 47) was released to producers in 1973. It is still the best clone with an average annual production over the total period of eight years of 8,50 kg/vine export-quality grapes (3 422 boxes/ha) and 11,09 kg/vine (4 465 boxes/ha) over the last five years with the vines in full bearing. The best of the remaining clones have received heat therapy for the elimination of viruses, and will be evaluated under a new project.

TABLE 1 - Performance of selected Barlinka clones in respect of yield of export quality grapes

Points position	Mean mass (kg/vine) per grade per year for											
	Period 1970-1977						Period 1973-1977					
	Export		Export black		Grade I		Export		Export black		Grade II	
	Clone	Mass	Clone	Mass	Clone	Mass	Clone	Mass	Clone	Mass	Clone	Mass
1	47	8,50	47	6,45	27	3,50	47	11,09	47	8,29	27	4,47
2	40	8,42	27	6,06	47	3,10	27	10,65	27	7,76	47	3,90
3	27	8,17	2	5,55	36	2,91	36	10,56	2	6,98	36	3,84
4	36	7,87	40	4,97	40	2,87	40	10,53	1	6,21	40	3,62
5	2	7,49	9	4,62	24	2,47	2	9,95	9	6,19	20	3,29
6	5	7,10	1	4,60	20	2,42	5	9,43	40	6,17	24	3,09
7	24	7,01	28	4,56	2	2,27	9	9,26	28	5,81	2	2,95
8	9	6,87	24	4,54	3	2,18	24	9,24	22	5,79	8	2,91
9	3	6,79	8	4,51	8	2,17	1	8,97	8	5,71	16	2,83
10	28	6,73	3	4,41	16	2,16	8	8,93	24	5,56	5	2,82
11	8	6,71	22	4,32	5	2,10	28	8,88	5	5,45	9	2,71
12	1	6,70	5	4,27	9	2,04	22	8,85	36	5,31	22	2,71
13	16	6,58	36	4,06	20	2,01	20	8,63	3	5,23	3	2,67
14	22	6,46	16	3,89	22	1,98	3	8,53	16	4,87	28	2,51
15	20	6,45	20	3,74	1	1,81	16	8,52	20	4,79	1	2,41

(S)WP.164/3: SELECTION OF TABLE-GRAPE CULTIVARS AND ROOTSTOCKS: SELECTION OF ALPHONSE LAVALLéE. 1968-1977

J.F.D. le Roux

After a selection programme involving Alphonse lavallée in which 637 vines were initially selected on 37 farms, 39 clones were tested in a statistical experiment. The experiment was recently terminated after data had been collected for seven years. A selected clone (No. 16) was released to producers in 1975. It is still the best clone with an average annual production of 9,40 kg/vine (3 785 boxes/ha) export quality grapes. The best of the remaining clones have received heat therapy for the elimination of viruses, and will be evaluated under a new project.

TABLE 1 - Performance of selected Alphonse Lavallée clones with respect to the production of export-quality grapes

Points position	Mean mass (kg/vine) per grade per year for the period 1971-1977							
	Export		First grade		Export black		Total mass	
	Clone	Mass	Clone	Mass	Clone	Mass	Clone	Mass
1	16	9,40	16	3,58	16	7,20	6	12,63
2	3	8,26	36	3,22	3	6,70	36	12,41
3	29	8,03	5	2,89	5	6,50	3	12,39
4	36	8,00	26	2,87	12	6,49	16	12,35
5	5	7,96	4	2,85	2	6,42	5	12,07
6	34	7,96	6	2,83	15	6,40	29	11,86
7	12	7,75	3	2,81	29	6,605	4	11,62
8	11	7,73	2	2,61	6	5,97	26	11,58
9	6	7,70	34	2,56	11	5,66	12	11,48
10	4	7,69	11	2,55	36	5,42	2	11,41
11	2	7,65	15	2,43	26	5,41	22	11,31
12	22	7,59	33	2,39	4	5,31	33	11,22
13	26	7,54	12	2,30	22	5,28	34	11,19
14	33	7,40	22	2,24	33	5,14	15	11,11
15	15	7,25	29	2,23	34	4,65	11	10,71

(S)WP.164/4: SELECTION OF TABLE GRAPE CULTIVARS AND ROOTSTOCKS: SELECTION OF QUEEN OF THE VINEYARD. 1969-1977

P.W. Smit

In a selection programme for Queen of the Vineyard in which 436 vines were initially selected on 24 farms, 26 clones were finally tested in a statistical experiment which continued for seven years. Although selected clone No. 1 was released to producers in 1973 it is now no longer considered to be the best and has been superseded by No. 24 which though sixth on the list for total export-quality grapes, was first with regard to first grade grapes and absence of millerandage.

The average annual production of clone 24 over the seven-year period was 7,34 kg/vine (2 952 boxes/ha) export-quality grapes. Of this, 4,21 kg/vine (1 693 boxes/ha) was without millerandage, which means a big saving of labour for the producer.

As has already been done with other good clones No. 24 will now be submitted for elimination of viruses and evaluation under a new project.

(S)WP.164/7: SELECTION OF TABLE-GRAPE CULTIVARS AND ROOTSTOCKS: SELECTION OF SALBA. 1971-1977

A.J. Hugo

After a selection programme involving Salba in which 253 vines initially selected on 14 farms, 12 clones were finally evaluated in a statistical experiment. The experiment has now been terminated after data had been collected for three years. Clone 11, which proved to be the best, was released to producers in 1977. The best of the remaining clones will be given heat therapy to eliminate viruses, and will then be evaluated under a new project.

(S)WP-BD.59/2: THE BREEDING OF NEW TABLE GRAPE CULTIVARS. 1966-1977

N. Hurter and P.J.L. Ellis

This programme was initiated to develop new cultivars which do not possess the deficiencies of the existing ones and would level off the present production peaks.

Several crosses have been made between selected parents since 1966. The seedling population that arose from these crosses was evaluated in trial vineyards. A number of promising selections was made and after further evaluation, both at experiment farms as well as with co-operative growers, one of these selections is about to be released as a new table grape cultivar. This selection, from a cross between Almeria and Queen of the Vineyard, possesses excellent berry quality and is resistant to berry cracking and rotting. It is well adapted to all grape growing areas, especially the summer-rainfall areas of the Transvaal. A number of other very promising selections is still undergoing final evaluation.

Publications:

Roos, T.J., 1966. Breeding problems of our table grapes. *Decid. Fruit Grow.* 16, 96-97.

Roos, T.J., 1968. A shortening of the generation interval in the grape and the importance thereof in the breeding programme. *Decid. Fruit Grow.* 18, 11-12.

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(S)W.I.49/1: VINEYARD CULTIVATION: INVESTIGATION OF THE COMPARATIVE EFFICIENCY OF DIFFERENT CONVENTIONAL AND MINIMUM SOIL-CULTIVATION PRACTICES IN VITICULTURE WITH REGARD TO MOISTURE AND OTHER PHYSICAL CHARACTERISTICS OF SOIL. 1969-1977

L. van Huyssteen

The principal aim of this project was to determine how the yield of wine grapes, and particularly wine quality, are influenced by different methods of cultivation. It was necessary to determine which physical characteristics of the soil are influenced by cultivation and to what extent. Since the trial was conducted under dryland conditions the effect of cultivation practices on soil-moisture conservation was also intensively investigated.

The experimental vineyard comprised Chenin blanc grafted on 101-14 and planted in a Clovelly soil. There were six different cultivation treatments:

- A shallow (150-200 mm deep) trench-furrow ploughed annually in alternate rows with weeds controlled by clean cultivation with a disc during the growing season.
- As above except that the furrow was 250 to 300 mm deep.
- A straw mulch on the soil surface with no mechanical cultivation at all.
- Chemical weed control by means of herbicides. No mechanical cultivation.
- Standard clean cultivation with a disc.
- Weed control with a rotary mower (bush cutter).

Determinations included: yield and shoot mass, shoot length, leaf analysis, evaluation of experimental wines and studies of root distribution.

A complete and comprehensive soil chemical and soil physical examination was done, including determination of the following properties and parameters: Organic-matter content, plant nutrient status, water characteristics of the soil by means of disturbed and undisturbed soil samples, soil moisture depletion, bulk density, porosity, compaction, soil temperature, water infiltration rate. The number of soil microbes and eelworm infestation were determined and an economical evaluation was carried out.

In comparison with the herbicide and clean-cultivation plots respectively, the rotary mower plots showed a loss in yield of 72,85% and 69,43% over six seasons. The straw mulch treatment increased yield above chemical weed control by 28,45%. Over six seasons the straw mulch plots yielded 44,44% and the herbicide plots 11,45% more than the clean cultivation treatments. The shot-mass data support these results.

Quality wines were made from the clean cultivation, straw mulch and herbicide treatments but wine made from the rotary-mower treatment was very poor. Musts from this last treatment showed retarded fermentation due to a low nitrogen content caused by competition between the actively growing grasses and the vines. Leaf analysis showed a higher nitrogen content in straw mulch vines than in vines from the rotary mower plots: 15,95% more in the 1974/75 season; 22,29% more in the 1975/76 season and 6,70% more in the 1976/77 season.

The rate of shoot growth is a sensitive indicator of plant-available soil-moisture. The shoot growth rate on the rotary-mower plots was lowest, with the clean-cultivated plots second lowest, while the herbicide plots had the second highest and the straw mulch plots the highest growth rate.

The top 100 mm layer of the minimum-cultivated plots (straw mulch, herbicides, rotary mower) had a higher bulk density than the conventionally cultivated plots (clean cultivation, trench furrow). For the deeper layers, the opposite was true and at the 200-300 mm depth the soils under clean-cultivation had the highest bulk density. The clean-cultivation plots were compacted up to almost 86% of the maximum potential compaction of this fine sandy clay loam soil.

Only on the herbicide plots was the porosity of the topsoil (200- 300 mm) higher than 48%, which is very near to the arbitrary optimum of 50%. At the 200- 300 mm depth the porosity of the clean-cultivated plots was only 36%.

There were indications that the more favourable soil structural conditions of the minimum-cultivated plots are beneficial to the water husbandry. Regarding the depletion of available soil moisture it was shown that the straw-mulch and herbicide plots conserved the rainwater that was stored during the winter and early spring. On the rotary mower and clean-cultivation plots the soil moisture was depleted early in the growing season of the vines. Big differences in soil-moisture tension among the different treatments were measured.

Vine roots prefer an even temperature and may even stop growing at very high soil temperatures. Soil temperatures showed a daily fluctuation to a depth of 508 mm and the mean soil temperature under the mulch was the lowest and also the most even at all depths. The rotary-mower and clean-cultivation plots had the highest mean soil temperature with the herbicide plots intermediate. There were no big differences between the maximum temperatures measured in the rotary mower, clean-cultivation and herbicide plots. The maximum soil temperature of the straw-mulch treatments at 50 and 150 mm depths was even lower than than the minima of the rotary mower, herbicide and clean-cultivated plots.

The water-infiltration rate on the rotary-mower and clean-cultivated plots was more than twice as high as that on the straw-mulch and herbicide plots thus indicating a favourable soil structure.

The straw-mulch and clean-cultivation plots had the highest number of soil bacteria in the 0 to 200 mm depth, with the herbicide plots the lowest. The same trend was found for fungi, but in that case the difference between the straw-mulch and herbicide plots was bigger. The eelworm counts showed a very large number of eelworms on the rotary-mower plots and especially on the roots of the weeds in these plots.

In the partial budget in which clean cultivation was used as control, the straw-mulch treatments showed a loss of R543,67/ha (due to the high cost of straw) for seven seasons. The herbicide treatments showed a profit of R653,24/ha for seven seasons over and above clean cultivation. The rotary-mower plots showed a loss of R3 761,59/ha (due to loss in yield) for the same period. This is very important because it can now be concluded that a straw-mulch is economically unacceptable and that the use of herbicides is a practical and economically attractive treatment on the kind of soil on which the experiment was done.

Results showed irrefutably that a vineyard under dryland conditions must be free of weed competition during the growing season of the vines and that weeds must be eliminated as competitors before bud-burst. Practices in which weeds and/or cover crops are controlled, but not killed, result in a serious decrease in vegetative growth and yield. Not all mechanical cultivation can be eliminated as it is still effective and economical provided it is reduced to a pracitcal minimum. The soil must be disturbed as little as possible to reduce the danger of soil compaction and other poor physical conditions.

CULTURAL PRACTICES

(S)WP.BD.58/5: CONTROL OF THE RELATIONSHIP BETWEEN VEGETATIVE VIGOUR AND BEARING CAPACITY OF TABLE GRAPES: INFLUENCE OF THE NUMBER OF BUNCHES PER VINE ON THE QUALITY, RIPENING AND VEGETATIVE VIGOUR OF ALPHONSE LAVALLéE GRAPES. 1971-1977

G.J. le G. Smit

The object of this experiment was to find a practical formula for crop control. Different numbers of bunches per vine per kg cane-mass obtained during winter pruning, were allocated to 6-year-old (1971) vines in a vineyard established on a heavy, black fertile soil on Bien Donné experiment farm.

In the past the recommendation has been 10 to 12 bunches per kg mass of cane removed during winter pruning. The results of this experiment conducted over seven seasons have, however, shown that it is not disadvantageous (not that it is much of an advantage either) to leave 14, or even 16, bunches per kg cane-mass. The general recommendation for Alphonse Lavallée vines on a fertile soil can therefore be increased to 12 to 14 bunches per kg cane-mass.

INSECT PESTS

(S)WI-39/1: THE RESISTANCE OF CERTAIN ROOTSTOCKS TO THE GRAPEVINE PHYLLOXERA. 1965-1976

C.A. de Klerk

A method was developed to determine the phylloxera resistance of rootstocks, using infestation as well as the vigour of the vine to calculate the degree of resistance. According to this method, cultivars are attributed certain levels of resistance which mutually are comparable.

Richter 99 was found to be the best phylloxera-resistant rootstock in the Stellenbosch area as well as in the Olifants River irrigation area. The resistance of Jacquez, which is the most generally used rootstock, was found to be very poor in both areas. It seems that this cultivar should not be planted on phylloxera-infested soils.

In the Stellenbosch area the resistance of the cultivars Rupestris du Lot, 3306, Dogridge, 143-B and 101-14 was found to be good. The resistance of Teleki, 333, 420-A and Fairy was not so good, however, and they cannot be recommended as rootstocks for this area. In the Olifants River irrigation area the resistance of 101-14, Salt Creek, 143-B, Richter 110, 3306 and Rupestris du Lot was good but that of Metallica and 333 was poor.

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OENOLOGY

(S)WI-23/8: INFLUENCE OF GRAPE HANDLING, PRESSING AND CELLAR PROCEDURES ON GRAPE AND WINE QUALITY: METHOD FOR DETERMINATION OF PHENOLS AND THEIR EFFECT ON WINE QUALITY. 1974-1977

A. Tromp

This project was initiated in order to ascertain the effect of wine phenols and colour of the wine on wine quality. Gas chromatographic, column chromatographic, precipitation and spectrophotometric techniques were employed to assay as many as possible of the phenolic moieties present in a red wine.

The reproducibility of the gas chromatographic method for monomeric phenols was too poor to be used for quantitative work but this method can be used quantitatively to identify phenols by the differences in their retention times.

Tannin and non-tannin phenols were determined qualitatively with the method of Peri & Pompei (1971) and both these fractions correlated with the astringency of the wines.

The sodium acetate column chromatographic method separated three tannin fractions, none of which correlated with astrigency. The method is also valuable for separating the red fractions of wines. Although the method has little applicability in practice, it is a valuable tool in phenol research.

The colour measurements of Somers (1974) have more practical value in that they can be used to describe the condition or state, i.e. ionisation and polimerisation, of the phenolic fraction in wine.

These methods failed to describe the phenolic wine fraction quantitatively and completely, and further research on methods for the separation and quantitative determination of phenols is necessary. However, valuable information has been gained on the role of phenols in wine quality.

Experimental wines were also evaluated organoleptically for quality as well as for separate wine characteristics such as astringency, colour, trueness to type, etc. The concentrations of the different phenolic moieties were subsequently correlated with the quality ratings of the wines. More than half of the properties measured, correlated highly significantly with wine quality - even moieties not expected to do so. The question thus arose whether these phenols contributed positively to wine quality because of their taste or odour, or because the colour of the wine increased with increasing phenol concentrations and with the judges subjectively giving higher scores to darker-coloured wines.

To evaluate the effect of colour on the subjectivity of the judges, twenty wines were tasted by a panel in normal light as well as in a dark room. A good correlation between the scores in the light and those in the dark was obtained ($r = 0{,}86$) but significant differences in the scores of individual wines were observed. For instance a wine receiving a score of 20% in the light was awarded a score of 55% in the dark. These differences could only be attributed to the effect of colour on the subjectivity of the judges. This was confirmed by asking the judges to award a score to the wines in the light by merely looking at the colour. A linear correlation with a correlation co-efficient of 0,97 between these scores and those obtained by normal tasting, was observed. In the case of red wine, therefore, judges base their evaluation of wine quality mainly on colour.

In doing research on the effect of palate and odour constituents on the quality of red wines, the tasting of the wines should be done in a dark room to remove the effect of wine colour on the subjectivity of the judges.

MISCELLANEOUS

DISEASES

(A)PS-Pr.39/2: VIRUSES AND VIRUS DISEASES OF DECIDUOUS FRUITS: ELIMINATION OF VIRUSES IN POME AND STONE FRUITS. 1970-1975

V.Z. Siebert and D.J. Engelbrecht

Various heat treatment procedures were investigated for the *in vivo* elimination of viruses from pome- and stone fruit clonal selections totally infected with one or more viruses. Best results were obtained using a walk-in chamber in which the temperature was controlled at 37 °C ± 2°, and where the growing tip was isolated from the heat-treated plant as soon as possible after treatment. This procedure is now being used routinely in the production of nuclear material since no horticultural aberrations have been observed. There was no correlation between the duration of the heat treatment and the number of plantlets freed from virus. The extreme tip (1 cm) of the young shoot was wedge-grafted into a young seedling of the same diameter. The tiny graft was held in position by self-adhesive crêpe bandage and enclosed in a small polythene bag. Propagation is possible in this way at any time of the year but, depending on the crop, most success was achieved with grafts made in the spring when about 30 to 90 percent grew. Subsequent tests showed that a proportion of the grafts was free of the viruses present in the mother plant.

STORAGE

(S)WP-Ks.12: STORAGE OF MISCELLANEOUS FRUIT. 1942-1977

L. Ginsburg, T.R. Visagie, A.B. Truter, J.C. Combrink,
J.G. Nel, D. Basson & J.J.A. Bester

CITRUS

Pre-cooling of oranges with air delivered at -0,5 °C

Washington Navels and Valencia-Late oranges were pre-cooled with air at -0,5 °C instead of at the normal temperature of 3,3 °C. The object was to improve the pre-cooling rate without harming the keeping quality of the fruit.

Orange export cultivars harvested at three different times during the season and from a number of different areas were pre-cooled with air at -0,5 °C and 3,3 °C to a storage temperature of 4,5 °C.

Except for a consignment of Washington Navel oranges picked late, all consignments investigated stored well at 4,5 °C irrespective of whether a pre-cooling temperature of -0,5 °C or 3,3 °C was used. Some Washington Navels developed a low incidence of rind-pit-injury but were still of fair commercial value.

Experimental commercial export trials confirmed that the use of air delivered at -0,5 °C for pre-cooling of oranges was a safe practice.

Low-temperature sterilisation of citrus

New Zealand and the United States of America demand low-temperature sterilization against fruit flies and false codling moth. Japan requires sterilization against fruit flies (for 12 days at -0,5 °C) and for false codling moth (24 days at 0,5 °C).

Grape-fruit, lemons and oranges were subjected to storage at -0,5 °C for 12 and 24 days and then at their optimum storage temperatures of 11,1 °C for grapefruit and 4,5 °C for oranges. Storage at the low temperature resulted in the development of variable degrees of rind-pit-cold-injury in all three types of citrus fruit. A low incidence of rind-stain was found to develop in a few consignments of oranges.

The incidence of cold injury in most instances was low, though an occasional consignment was found to develop rind-pit in excess of 10,0%. The intensity of the rind-pit injury was low and the palatability unaffected. The incidence of rind stain was very low and it largely disappeared when the fruit was held at an ambient temperature of 21 °C.

No consistent factor such as production-area or picking-stage could be associated with the development of cold injury in citrus fruit.

These tests proved that low temperature injury development occurred during exposure of different citrus fruit to -0,5 °C for 12 and 24 days. The incidence and intensity of the cold injuries were generally low and justified recommendations that citrus fruit could be exported if low temperature sterilization for 12 or 24 days was necessary. Subsequent commercial experience has confirmed this.

Loss of mass on cold-injury development in grape-fruit

Grape-fruit consignments were treated using air at 25 °C with RH at 50.0% until they had lost from 1,0% to 0,5% mass. They were then subjected to low-temperature sterilization at -0,5 °C for 12 and 24 days, followed by storage at 4,5 °C for periods of up to 30 days.

The samples which were subjected to low-temperature treatment without suffering any forced loss of mass prior to low-temperature sterilisation developed 16.0% cold injury. This compared poorly with 2,0 to 3,0% cold-injury development for the consignments which were subjected to low-temperature sterilisation treatments after the oranges had lost controlled amounts of mass amounting to from 2,5 to 5,0%. The samples stored at 11.1 °C without low-temperature sterilization were free from cold-injury. This failure to develop cold-injury in grape-fruit is not necessarily the result of a loss of mass but may be due to conditioning of the fruit at a high temperature before its exposure to low-temperature treatments.

Influence of different CO_2 concentrations on the storage of grape-fruit

Marsh's Seedless grape-fruit consignments were stored for 30. 60 and 90 days at 11,1 °C in tanks with CO_2 concentrations from 0 to 5,0%. The different levels of CO_2 were maintained in the tanks by means of restricted and controlled rates of ventilation in the tanks held in a cold store at 11,1 °C.

Two seasons' results showed that levels of CO_2 in the storage atmosphere from a trace to 1,0%, had no adverse effect on the keeping quality of the grape-fruit. Results during the second season indicated that CO_2 concentrations of 2,5% and higher resulted in increased incidence of fungal decay. compared with samples held in a 1% or lower CO_2 concentration during storage at 11.1 °C.

It was not possible to conclude whether the increased fungal decay which had resulted was due to the higher CO_2 contents or whether it was due to restricted vetilation rates during storage.

GUAVAS

Fan Retief and Malherbe guavas picked at two stages of maturity were stored at temperatures ranging from -0,5 °C to 10,0 °C for periods of up to 21 days. Some samples were jumble-packed in lug-boxes and others in sealed polyethylene (grade 150 g) bags.

Guavas were found to possess a poor keeping quality. The optimum picking stage was reached when the fruit was fully developed, firm, and had a green ground colour. The best storage temperature was 4,5 °C with a maximum safe storage life of 7 days. After 14 days' storage at 4,5 °C, 19% and 38% decay developed in the green and ripe-harvested fruit respectively.

CAPE GOOSEBERRIES
(Physalis peruviana)

Packaging and storage conditions for the export of cape gooseberries by air and sea were determined

The best pack for air-export proved to be unshelled berries in perforated polyethylene bags without the application of any cooling.

Both shelled and unshelled cape gooseberries were found to store well for three weeks at temperatures from -0,5 °C to 10 °C. The best colour development and maximum retention of ascorbic acid took place at 4,5 °C. The incidence of decay was very low at all the storage temperatures involved. Unshelled berries were preferred as the shell provided a natural protection to the berry against bruising.

Pilot-scale shipping trials at -0,5 °C, which was the only available temperature at the time, were very successful and high prices were realised.

STRAWBERRIES
(Air and sea transport of cultivars Klaradyn and Festival)

A unitised strawberry pack was developed in which strawberries were packed in polystyrene punnets which fitted into unlidded cartons. Four of these cartons were unitised by means of a special metal handle which fitted through the ends of the cartons. A master corrugated cardboard wrap-around sheet was used to close the unitised pack. Experimental consignments of large Klaradyn and Festival strawberries packed in single layers, and smaller berries jumble-packed in the punnets were exported by air. They arrived in very good condition. This was followed by several small commercial consignments throughout the strawberry season. All arrived overseas in a sound condition and fetched good prices.

The storage life of Klaradyn and Festival strawberries packed as for air export and held at -0,5 °C and 90% RH proved too short to justify the export of strawberries by sea.

CHERRIES

The storage of seven cherry cultivars grown in the Ficksburg area was investigated with a view to export by sea. They were packed in wooden boxes which were pre-cooled in Bloemfontein and transported by rail in an ice-truck to the Cape where they were stored at 0,5 °C for 19 days followed by 7 days at 15 °C.

Black Biggareau, Giant Heidelfinger and Bing retained their lustre well, developed very little fungal decay and had a high dessert quality after storage. Black Tartarian had a poor keeping quality while Emperor Frances and Napoleon Biggareau stored well but lacked flavour and were more suited for processing. Black Biggareau, Giant Heidelfinger and Bing cherry cultivars were all recommended as suitable for export.

AVOCADOS

Storage tests were carried out on Fuerte, Nabal and Itzamna avocados, grown in the Western Province, at temperatures ranging from -0,5 °C to 10 °C.

The best storage temperature for the Fuerte cultivar proved to be 5,5 °C and the riper the fruit when picked the more susceptible it was to cold injury during subsequent storage. The amount of cold injury (this is recognisable by the development of dark patches of the skin and flesh) was influenced by storage temperatures below 4,4 °C as well as the oil content. The best storage results were found for Fuerte avocados when picked with an oil content of 15 to 17 per cent.

The Nabal cultivar was found to be less sensitive to storage temperature, and may be stored at temperatures of between -0,5 °C and 7,0 °C. The fruit ripens too rapidly when stored at temperatures above 7,0 °C.

Tentative results for the Itzamma cultivar indicate that -0,5 °C may be the best storage temperature here too but this has still to be confirmed.

PERSIMMONS
(Diospyros kaki L.F.)

Tanenachi, Mazeli and Tipo-Tipo persimmon cultivars were stored at temperatures ranging from -0,5 °C to 7,0 °C for three weeks and a further week at a shelf temperature of 15 °C.

All three cultivars stored well at -0,5 °C for three weeks and developed a high dessert quality during a further week at 15 °C. Higher storage temperatures led to some ripening during storage and flesh discolouration occurred at temperatures above 3,0 °C.

Publications:

(In addition to the following there were 28 Technical Reports)

Boyes, W.W., 1953. The keeping quality of avocados. *Fmg in S.A.* 28(324), 103-106.

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Ginsburg, L. & Boyes, W.W., 1969. Storage of Washington Navel and Valencia late oranges at temperatures low enough to destroy all traces of fruit fly. Food Preservation Symposium Afrox 79-90.

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STRAWBERRIES

STORAGE

(S)WP.207/7: STUDIES ON QUALITY: PACKING AND COOLING OF STRAWBERRIES FOR EXPORT BY AIR. 1974-1976

A.B. Truter, L. Ginsburg,
C.W.J. Bester and G.W. Reddek

Tests to determine the best type of container for the export by air of strawberries from the Cape were initiated during 1974. During the first season two types of packing material were tested viz. a non-vented outer polystyrene container holding 24 punnets and a vented carton holding 12 ribbed punnets. In both cases the strawberries were packed in single layers and pre-cooled to 10 °C.

Consignments were exported and the South African Agricultural Produce Inspectorate in London examined the fruit and reported back. Samples were also held back at the Fruit and Fruit Technology Research Institute (FFTRI) and subjected to simulated flight conditions.

Overseas buyers preferred the fruit in the polystyrene containers and paid consistently better prices for them than for the cartons. Temperature recordings monitored during flights showed that temperatures in the cartons rose and fell corresponding with the fluctuations in ambient conditions, while those in the polystyrene pack rose slowly and steadily.

Despite the preference shown overseas for the polystyrene pack, further trials with the vented carton and ribbed punnets were undertaken during the 1975 season. Rapidly rising prices of polystyrene and problems presented large-scale pre-cooling in this pack, militated against its use.

A vented carton, containing 8 ribbed punnets each holding 250 g strawberries packed in double layers, was developed in co-operation with carton manufacturers. Forty-two of these filled with pre-cooled fruit were packed in a non-vented cardboard outer container fixed on a non-returnable wooden pallet. This pack was so enthusiastically received by overseas buyers that it was felt that no further work was necessary in connection with the pack.

Determination of the extent and the future of pre-cooling necessary for strawberries exported by air was another aim of the tests undertaken. Some of the strawberries were pre-cooled to 10 °C directly after packing on the farm, at the FFTRI and in cold stores at the D.F. Malan airport, while others were not pre-cooled. It was established that pre-cooling was essential for quality retention of the strawberries but the results did not show any marked trade preference for any one of the different pre-cooling treatments.

During 1975 different lots of fruit were pre-cooled to -0,5 °C, 4,4 °C, 7,2 °C and 10 °C respectively, and no other pre-cooling. Overseas reports again showed a marked preference for the pre-cooled fruit, but no differences could be detected between the results of the different treatments. Samples held back at the FFTRI, however, showed that temperatures of -0,5 °C and 4,4 °C resulted in a better retention of strawberry quality than those pre-cooled to 7,2 °C and 10 °C, respectively.

A further series of pre-cooling tests was conducted during the 1976 season. Temperatures of 1,7 °C, 5,6 °C and 10 °C were used and cooling was commenced 3, 6 and 10 hours after harvesting, respectively. The tests showed that all the pre-cooling treatments were successful, with the lower temperatures resulting in a slightly better quality.

The main cultivar exported was Parfaite, but small quantities of Tioga, Selekta and Selection 71/7 were also exported. Buyers in Paris preferred Parfaite and those in London preferred Tioga.

It was proved that strawberries picked at 50% red colour will attain full colour within two to three days from harvesting. Tests with 75% red to full-light-red berries were successful. The U.K. trade preferred strawberries somewhat on the acid side. South African producers found picking at 50% red impractical because it slowed down harvesting. The aim should be to pick at 50% red but fruit from 75% red to full-light-red should also be acceptable.

The tests showed that double-layer packs with fairly large berries (25 to 30 mm diameter) were preferred. Consistency of berry size is more important than large fruit and place-packing is necessary to ensure 250 g berries per punnet. To immobilise the pack and maintain a high relative humidity around the fruit, thus ensuring freshness, stretch film was wrapped over the fruit.

It was shown that strawberries exported on night flights arrived in a fresher condition than those on day flights probably because night temperatures are lower and more consistent than day temperatures.

Publications:

Truter, A.B., Ginsburg, L., Bester, C.W.J. & Reddek, G.W., 1975. Packing and cooling of strawberries for export by air. *Decid. Fruit Grow.* 25, 289-295.

Truter, A.B. & Ginsberg, L., (1975) Practical hints on the handling of strawberries for export. *FFTRI Information Bulletin* No. 314.

Medicinal Plants

BUCHU

PROPAGATION

(S)WP.182/1:

CULTIVATION OF BUCHU (*AGATHOSMA BETULINA, A. CRENULATA*): PROPAGATION METHODS. 1970-1977

K.L.J. Blommaert

The main objects were to propagate clonal material from selected plants high in oil and diosphenol content and to find means of identification to distinguish the two *Agathosma* species.

Both the conventional and mist-bed techniques were used, together with hormone treatment to stimulate rooting, but all attempts to root softwood and hardwood cuttings proved unsuccessful. The major limiting factor appears to be survival of the cuttings.

The possible causes of poor seed germination were investigated and it was concluded that the most important contributory factor is probably the harvesting of immature seed. More uniform germination can be obtained by pre-sowing exposure of the seeds to dry heat (20 to 40 min. at 80 °C).

Chemo-taxonomic aspects: Measurement of leaf form of buchu plants collected in local plantings indicated that while measurement is the only taxonomic criterion for distinguishing the two species and is a reliable method of identification. This does not hold true, however, for hybrid buchu. Gas-liquid chromatographic and ultra-violet analysis of buchu oils showed that the presence of a relatively large percentage of psi-diosphenol and diosphenol in *A. betulina* leaf oil only, is a valid criterion for botanically separating the two species. The analyses also showed that there is a wide variation in the percentage composition of the major oil components and in the percentage of oil obtained from different buchu plants.

Publications:

Blommaert, K.L.J., 1971. Buchu cultivation. *Information Bulletin* No. 14. Fruit and Fruit Technology Research Institute, Stellenbosch.

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Blommaert, K.L.J., 1972. Cultivation and processing of buchu. Proc. 9th Int. Conf. Essential Oils. *Anais da Academia Brasileira de Ciëncias* 44, (*Supplemento*) 70-72.

Blommaert, K.L.J., & Bartel, E., 1976. Chemotaxonomic aspects of the buchu species *Agathosma betulina* (Pillans) and *Agathosma crenulata* (Pillans) from local plantings. *J.S. Afr. Bot.* 42, 121-126.

Pastures

CULTIVATED PASTURES

BREEDING

N-Ce.119/1:

SURVEY OF THE MODE OF REPRODUCTION OF CERTAIN GRASSES AND LEGUMES IN SOUTH AFRICA: *CYNODON* SPP. 1970-1977

J.M.L.C. Rhind, D.C.W. Goodenough, J.D.H. Reusch

A cytogenetic study was undertaken of *Cynodon dactylon* accessions considered to be potentially suitable for inclusion in a programme of radical veld improvement. Apart from good herbage yield and spreading ability, it was considered esential that such material should have high fertility (seed production) and good seed-germination capacity.

On the basis of chromosome number, 51 accessions were found to comprise a polyploid series consisting of 42 tetraploids ($2n=36$), four triploids ($2n=27$) and five diploids ($2n$-18).

Pollen viability was determined using the aniline-blue lactophenol method and ranged from 1,2% to 97,0%. Low pollen viability was usually associated with meiotic irregularities.

Seed production, as well as seed-germination capacity, were, generally speaking, extremely poor.

It was concluded that the climate at Cedara is not suited to seed production in this species.

119/2: *PENNISETUM CLANDESTINUM.* 1970-1977

J.M.L.C. Rhind, D.C.W. Goodenough, and J.D.H. Reusch

A cytogenetic study was undertaken of *Pennisetum clandestinum* accessions considered to be potentially suitable for inclusion in a programme of radical veld improvement. Apart from good herbage yield and spreading ability, it was considered that such material should have high fertility (seed production) and good seed-germination capacity.

Somatic chromosome number was determined in 20 accessions using the Fuelgen squash method. All accessions were tetraploid (2n=36).

Pollen viability was determined using the aniline-blue lactophenol method and ranged from 72,0% to 99,5%. All accessions produced viable seed, germination capacity ranging from 43,5% to 84,0%.

Studies of megasporogenesis led to the tentative conclusion that the mode of reproduction was sexual rather than apomictic.

FERTILIZER

N-Ec.20/3: MINERAL NUTRITION OF PASTURES ON THE PARTLY LEACHED SOILS OF NATAL: N, P AND K FOR *ERAGROSTIS CURVULA* ON A CLAYPAN SOIL OF THE F_1 ASSOCIATION AT DE HOEK. 1969-1973

J.H. I'Ons and P.E. Bartholomew

A small-plot cutting-trial conducted under dryland conditions on a claypan soil (Estcourt soil series) at de Hoek indicated the response of *Eragrostis curvula* (cv. Ermelo) to levels of N, P and K.

Four levels of N (50, 200, 350 and 500 kg/ha/annum), as limestone ammonium nitrate, four levels of P (10, 40, 70 and 100 kg/ha/annum) as single superphosphate. (Double these quantities of P were applied in the first year) and two levels of K (nil and 200 kg/ha/annum) as muriate of potash, were used in a factorial design with two replications. The trial was established during November 1969 and terminated at the end of the 1972/73 season.

The quadratic response to increased N levels, recorded for each of the seasons, and the mean over all seasons, indicates that there is little justification for exceeding 350 kg N/ha/season. The mean response (three productive seasons) was 3 173, 7 954, 9 509 and 9 270 kg dry-matter/ha/season for the increasing N levels. A quadratic function fitted to this data indicates that maximum production can be expected at 400 kg N. Adverse effects of excessive N (500 kg/ha/annum) were manifest in a certain amount of "die-out" during the season of establishment, followed by a temporary invasion by *Hyparrhenia* spp., the tendency for *E. curvula* to "go to seed", and more severe wilting during dry spells on plots receiving higher N.

Increasing the level of P resulted in a significant quadratic yield response during the establishment season, but a linear (significant for each of the seasons) response during subsequent seasons. Mean dry-matter yields increased from 6 555 to 7 340 to 7 867 to 8 143 kg/ha/season as the level of P was increased.

Potash applications increased yields significantly during the last two seasons of the trial, with yield differences approaching significance during the season following establishment. The mean increase in yield was from 7 165 to 7 787 kg/ha for an annual application of 200 kg K/ha. There would seem to be little justification for exceeding 200 kg K/ha/season.

The N x P interaction recorded for each of the seasons and for the mean yield over the three full seasons followed the same pattern. Increasing N at low P, and *vice versa*, had little effect on yield, the response to increased P (or N) being manifest only at higher N (or P) levels.

A square-root function fitted to the mean N x P yields (correlation coefficient = 0,9918) over the last three seasons, illustrated the N x P interaction well. Figure 1 illustrates the response surface derived from the square-root function. The N x P data indicate that there is little justification for exceeding an annual application of 10 kg P/ha (with 20 kg P basal) at 200 kg N, and 40 kg P/ha (80 kg P basal) at 350 kg N/ha.

The data in Fig. 2 illustrate the different combinations of N and P that can be used to attain a specific dry-matter yield (isoquants). The use of qualitative data instead of quantitative data, would probably provide a more realistic basis for determining the most economical (isocline intersect with isoquant) N and P level. N.B.: In Fig 2 the isoclines R = 4, R = 1,71, R = 1 and R = 0,25 represent the "least-cost paths" when a unit of P is four times that of N; N costs 41 cents and P 71 cents/kg; N and P cost the same and N is four times as expensive as P.

Nitrogen, P and K had little effect on the time at which maximum growth rates were recorded. The low level of N was inferior in terms of growth rates - as shown by inferior dry-matter yields.

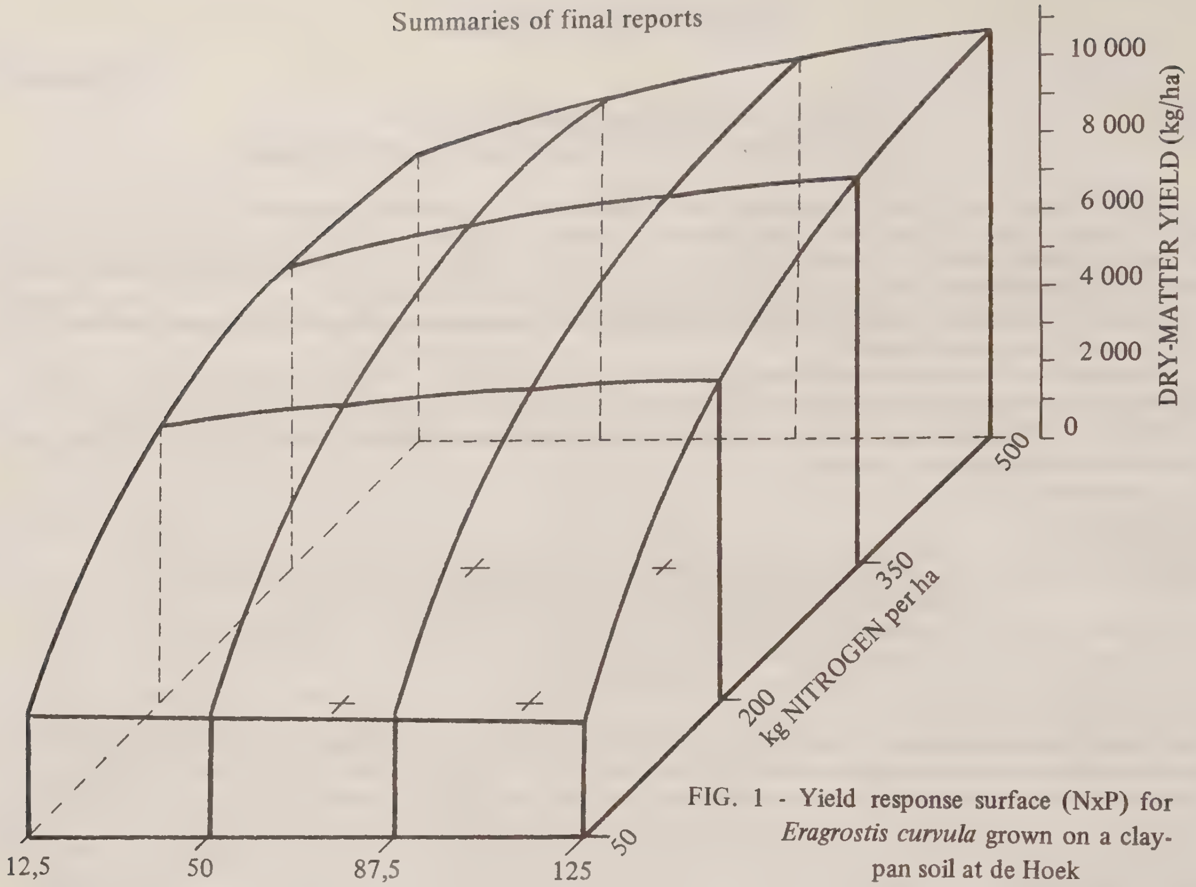

FIG. 1 - Yield response surface (NxP) for *Eragrostis curvula* grown on a claypan soil at de Hoek

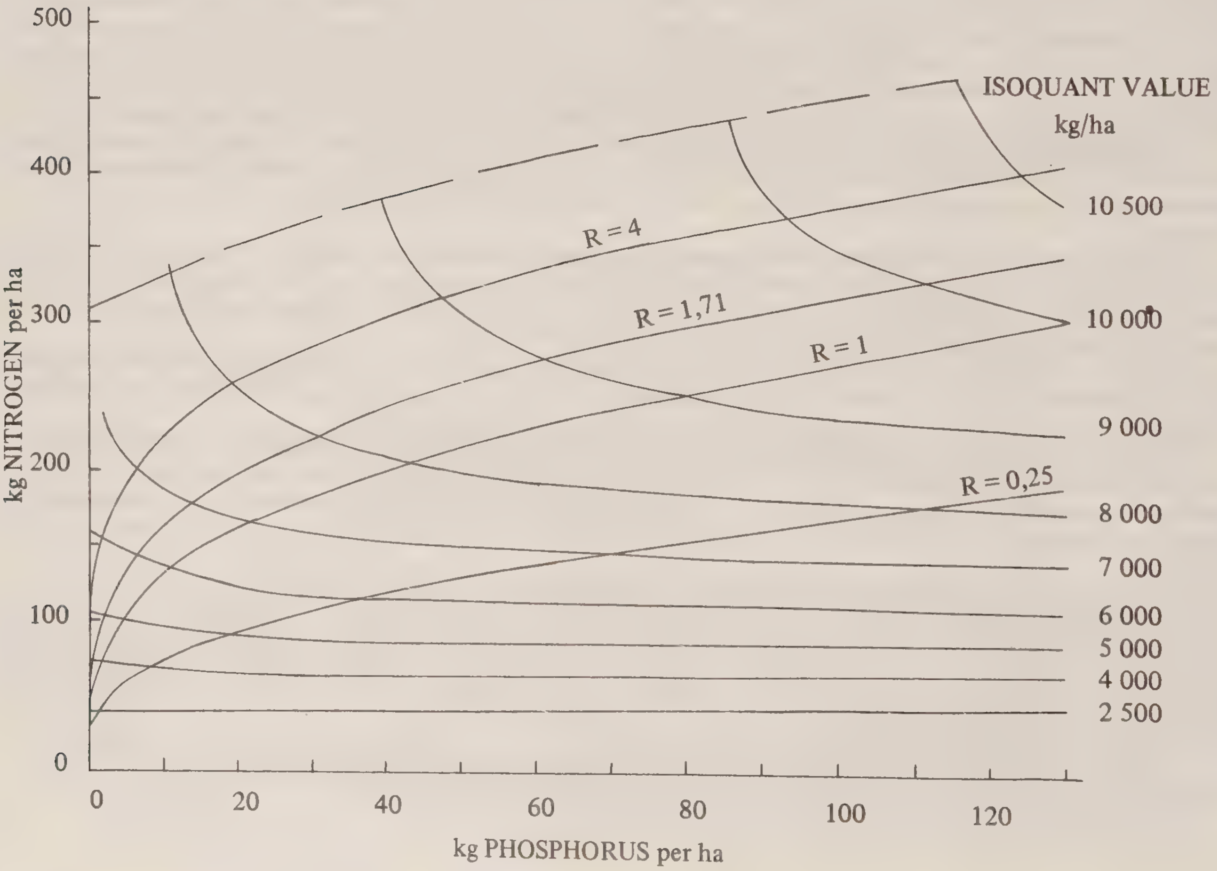

FIG. 2 - Isoquants and isoclines for *Eragrostis curvula* grown on a claypan soil at the Hoek

HAY

W-Oq.19: PRESERVING HAY WITH CHEMICAL PRESERVING AGENTS IN THE HUMID GEORGE AREA. 1972-1974

J.E. Volschenk and P.C.J. Maree

A preserving agent 'Hay Savor', manufactured in the United States of America, which enables hay with a moisture percentage of 25-30 per cent to be baled directly after mowing was evaluated in the humid coastal area of George/Knysna. Treatment with 0,91 kg preserving agent per 907,2 kg hay resulted in a condiderable increase in the properties palatibility, higher mass gains of test animals, percentage organic material digested and total digestible nutrients.

Number of fungi, percentage fibre, crude protein and temperature of the bales were not significantly influenced by treatment with the preservative. The use of this agent has merit.

MANAGEMENT

N-Ce.76/2: DEFOLIATION OF PERMANENT CULTIVATED PASTURES: FREQUENCY AND HEIGHT OF MOWING OF PASPALUM/LADINO PASTURES IN SUMMER AND AUTUMN. 1965-1971

R.I. Jones and G.W. Cross

Summer pastures in Natal can be so managed as to change their production and botanical composition by varying the height or frequency of defoliation, or both. This notion underlies the practice of rotational grazing, although critical data to substantiate it have been lacking. It is widely believed, for instance, that the persistance of ladino clover is dependent on frequent, close defoliation. The experiment reported here shows the opposite to be true.

The experiment was laid out on a bottomland on Cedara Agricultural Research Station, near Pietermaritzburg.

The treatments, and the symbols denoting them, were as follows:

P - frequency of summer defoliation: PO/P1/P2 = mown after 75/175/275 mm regrowth,
S - intensity of defoliation in summer: SO/S1 = cut to less than 15 mm/more than 50 mm above ground level.
F - frequency of autumn defoliation: FO as PO, and F1 as P1.
A - intensity of autumn defoliation: AO as SO, and A1 as S1.

The design was a 3 x 2 x 2 x 2 factorial in three replications.

Annual topdressings of superphosphate (475 kg in spring), of muriate of potash (4 x 140 kg), and of N (4 x 50 kg) were applied.

1. Mean yields over the first 4 years:

1.1 Dry-matter yield at first spring cut, mean per season.

Frequency of cutting in summer had marked effects on spring yields of each sward component (P/_0,001), as shown in Table 1. Longer intervals between harvests decreased the spring yield of Paspalum and increased the yields of clover and of weeds (mainly *Bromus catharticus* and *Lolium multiflorum*). The overall effect on the total sward yield was negligible.

TABLE 1 - Residual effects of frequency of summer cuttings: mean dry-matter yields (kg/ha/season) at first cut in spring - mean over 4 seasons

	P0	P1	P2	S.E.
Paspalum	608	394	255	33.6
Clover	701	805	914	40.9
Weeds	187	164	313	21.2
Total	1 496	1 363	1 482	46.9

1.2 Dry-matter yields per season.

The overriding influence on yields was that of summer cutting frequency, as shown in Table 2.

(a) Paspalum mean yield per season was not significantly affected by any treatment, although the tendency was for yields to decrease with lower frequency of summer cutting.

Cutting height also had somewhat varying effects on Paspalum yields, high cutting viging better yields at times but not others. The more important effect of cutting height was that closer defoliation greatly suppressed the flowering of Paspalum.

TABLE 2 - Mean yield of dry matter, ton/ha/season over 4 seasons, excluding first harvest in spring

	P0	P1	P2	Mean	S.E.	C.V.%
Paspalum	2,17	2,00	1,95	2,04	0,099	24
Clover	1,69	2,57	2,86	2,37	0,106	22
Weeds	0,66	0,61	0,85	0,71	0,037	25
Total	4,51	5,18	5,66	5,12	0,060	6

(b) The clover responded very favourably every year to less frequent summer cutting (P/_0,001), the P2 yield being 70% greater than the P0 yield on average. Less frequent cutting in autumn also improved the clover yield (P/_0,01), and the lower cutting height in autumn gave a slight increase in clover average yield (P/_0,05). These effects were all additive, and mean yields ranged from 1,45 tons/ha/season under frequent cutting all season (P0F0) to 2,99 tons under infrequent cutting (P2F1), which was not significantly better than the 2,82 tons obtained from the P1F1 treatment.

(c) Total yield of all species was linearly dependent (P/_0,001) on summer cutting frequency (Table 2). It also increased slightly (from 4,97 to 5,26 tons/ha) with less frequent cutting in autumn (P/_0,001).

2. Treatment reversal:

In the fifth season (1969/70) treatments were reversed to try to reverse the effects of summer cutting frequency, namely the dominance of clover over Paspalum in the treatments cut infrequently.

After uniform mowing of all plots in October 1969, the only differential treatment applied was three frequencies of defoliation (to a height of about 70 mm). Plots previously cut infrequently (P2) were now cut frequently (Q0), and *vice versa* (P0 became Q2), while the previous intermediate frequency (P1) was now cut at very long intervals (Q3).

In November 1970, the effects of these treatments were assessed by determining yields of ladino, Paspalum, and weeds, for comparison with yields obtained the previous spring.

After one season of reversed treatments, it was very clear that frequent cutting (Q0) caused a large increase in Paspalum, while less frequent cutting (Q2 and Q3) caused Paspalum to decrease. In other words, the most favourable change in Paspalum was still found in the most frequently mown plots (P/ 0.001).

The clover decreased at all cutting frequencies. As was expected, it decreased most under most frequent cutting (Q0) and least in the Q2 treatment (P/_0.001). The very infrequent cutting (Q3) was more harmful than the Q2 level, but less harmful than Q0 (P/_0.001).

It is concluded that frequent defoliation favours Paspalum and infrequent cutting favours ladino clover.

Discussion:

Paspalum and clover are mutually exclusive, and their co-existence depends on differences in the micro-habitat brought about by treatments and random variations in the various physical factors. Clearly the major factors determining clover dominance were frequency of defoliation, especially in summer, and block effects (presumed to be soil moisture effects). Coupling of infrequent defoliation with wet soil virtually guaranteed clover dominance, while frequent defoliation and drier soil ensured Paspalum dominance.

Infrequent cutting in summer favoured weeds relative to Paspalum. It would seem that the clover in the plots cut infrequently is very susceptible to hot, dry weather and long spells of such weather conditions set the clover back or even kill it, the resulting bare patches being colonized by opportunist species. It was noticed after several such events that the return of favourable weather caused a rapid recovery of the clover which spread faster than the Paspalum into the weed areas. Of course, such recovery depends on there being a sufficient reserve of clover in protected patches such as moist hollows, and on the weeds being mown down.

Cutting height had important effects on the balance between Paspalum and weeds. Surprisingly, there was no detectable response of clover to cutting height. The requirement of heavy defoliation in summer and light defoliation in autumn, to ensure Paspalum dominance over weeds, is the opposite of what may be expected on farms where summer is a time of plenty and of water-utilization, while the opposite holds true in autumn. Nevertheless, there is the prospect of controlling the Paspalum/clover balance by manipulating cutting (or grazing) frequency in summer, and of keeping weeds in check by manipulating height of defoliation.

Total yields of forage in spring (average of 4 seasons) were hardly affected by treatments, despite the response of sward components to treatments. It follows that the quality of the forage will be affected by treatment. Mean annual total yield was affected by cutting frequency in summer, increasing in parallel with an increase in the yield of the clover constituent, as cutting frequency decreased.

One effect of cutting height not revealed by any figures was most striking to see: Whereas Paspalum 001flowered freely in plots cut high in summer, it hardly flowered at all in plots cut low.

N-Ce.98/4: COMPETITION IN GRASS ASSOCIATIONS: EFFECT OF SELECTIVE DEFOLIATION. 1968-1971

R.I. Jones, G.W. Cross and I. Macdonald

Selective defoliation is a powerful force for botanical change. The effect of various degrees of selection, and particularly the choice of a management system to control pastures of *Paspalum dilatatum* and ladino clover which were subject to invasion by *Eragrostis plana* (mshiki), were investigated.

Two similar experiments were conducted simultaneously. In each, two sets of plants called A and B, were grown both separately and in mixed stands, in small plots. In experiment I, sets A and B were, respectively, *P. dilatatum* and Ladino white cover. In experiment II set A was these two species collectively, and B was *E. plana*. A high level fertilization was followed and cutting treatments were applied every 4 weeks.

The A plants were cut to 25, 75 or 125 mm above ground level (C1, C3, C5) and the B plants were cut to the same heights (D1, D3, D5) but independently of the A set. In pure stands of A or B, all plants were cut to the same height.

The responses to treatments were so rapid and so dramatic that it was easy to see why a little mismanagement of a pasture can do a great deal of damage in a short time. It was also obvious that good management would be able to rectify the damage just as rapidly, the only problem being that the kind of good management required may not be practicable.

Conclusion:

The relationship between Paspalum and clover is closely linked to the index of selective defoliation, implying that the ratio of stubble heights is important. When the selection index is zero (both species defoliated to the same height), then some other factor determines whether the Paspalum or the ladino will tend to be dominant. Competition between 'mshiki' and Paspalum/clover is less depedent on the index of selective defoliation. Rather the agressiveness of 'mshiki' seems to be maximal when it is cut to any height greater than Paspalum/clover, minimal (negative) under the opposite conditions, and zero if defoliation is not selective.

In practice, we wish to minimize 'mshiki' invasion and to maximize clover persistence. Both objectives are best served by uniform defoliation of the sward to 25 mm, but uniform defoliation to any height is better than the selective defoliation which will occur in uncontrolled grazing. However, uniform defoliation merely prevents species change under the forces of selection - it cannot prevent species change due to other forces. This implies that species manipulation by altering defoliation frequency, irrigation, fertilization, etc., is possible or will take place even when pastures are defoliated non-selectively.

(To be published in *Proc. Grassld Soc. sth. Afr.*)

98/6: BOTANICAL CHANGES IN PASPALUM/CLOVER SWARDS IN RELATION TO INITIAL COMPOSITION, FERTILIZATION, AND CUTTING FREQUENCY. 1968-1971

R.I. Jones, G.W. Cross and C.I. MacDonald

The experiment was conducted at Cedara Agricultural Research Institute, in the 'ngongoni' mistbelt near Pietermaritzburg on a red doleritic soil (Hutton series). Although the rainfall averages 870 mm, a very dry year seriously impaired the experiment in its first year. The treatments comprised 4 levels of nitrogen (nominally 61,132, and 265 kg/ha but quantities varied according to the season), two of potash (13,25 and 79,5 kg KCl/ha, repeated every 6 weeks), and two frequencies of cutting in which plots were mown every 3 or every 6 weeks. Also, different mixtures were planted, ranging from pure grass, through grass : clover ratios of 9:1, 1:1 and 1:9, to pure clover. The 1.1 ratio was either sown in 230 mm rows or broadcast.

It is concluded that ladino clover will survive more satisfactorily in Paspalum pastures if (a) a good stand of clover is obtained at establishment, (b) potash is at a sufficiently high level, and (c) the pasture is grazed every six rather than every three weeks. In monoculture, clover yields reponded best to less frequent defoliation.

There are likely to be modifying conditions, however. Firstly, the clover showed a surprisingly positive response to nitrogenous fertilization. This indicates that the clover's nitrogen-fixing capacity was limited. Adverse weather after planting and a very dry first season could account for this. Secondly, the experiment suffered from lack of rain and it is not unlikely that the grass would have responded more vigorously to the N, if water supply had been better. More grass would shade the clover more heavily and so swing the balance in favour of more frequent, rather than less frequent, defoliation for better clover persistence. A significant result obtained in the second season supports this hypothesis. The ladino responded best to less frequent cutting as did the Paspalum, with the level of N determining which species benefited most. With 61 kg N/ha, or less, every 6 weeks, the clover did well, but at higher rates of N the grass did better.

There was no noteworthy effect of row-planting on clover persistence, but this is inconclusive, again because of the dry conditions experienced. The grass may well have been less aggressive than would be the case with normal rainfall.

The yield of clover in spring of the third year (45 months after sowing) is of interest for gauging clover persistence. Owing to the overall decline in clover population by that time, and the high coefficient of variation (90%), the only result of importance was that clover dry-matter yields at the final harvest were linearly related to the initial clover content of the mixtures (P/ 0,001). Mean yields of clover dry matter were 2,8; 10,6; and 28,3 g/plot in the plots sown 9:1, 1:1, and 1:9 of Paspalum:clover initially, and 15,5 g per monoculture half-plot (S.E. = 2,16). The mean yield of clover (13,1 g) was less than a quarter of the mean grass yield (56,6 g/plot) in the mixtures, and only in the plots sown to nine times as much clover as grass initially, was there a reasonable ratio (1:1) of grass to cover 45 months after sowing.

N-Ce.98/7:

COMPETITION IN GRASS ASSOCIATIONS: EFFECT OF FERTILIZATION AND CUTTING ON SWARDS OF PASPALUM, LADINO CLOVER, AND MSHIKI. 1968-1971

R.I. Jones and G.W. Cross

Grass/clover perennial pastures in Natal usually degenerate from a rich, clovery sward to a grassy sward dominated by pioneer grasses such as *Eragrostis plana*, or 'mshiki'. The process is without doubt a result of mismanagement aggravated by unfavourable moisture conditions. This experiment was set out to examine the effects of nitrogen, phosphate and potash applications, and height and frequency of mowing, on pure and mixed swards of *Paspalum dilatatum*, ladino clover, and *E. plana*.

A 2^5factorial with split plots, in one replication, was laid out on a red Hutton soil at Cedara Agricultural Research Station, near Pietermaritzburg, with the following treatments:
NO, N1 = 0,133 kg N/ha (as limestone ammonium nitrate) every 6 weeks;
PO, P1 = 53,530 kg superphosphate per ha in spring;
KO, K1 = 13,80 kg/ha muriate of potash (50% K) every 6 weeks;
QO, Q1 = cut every 3 or 6 weeks;
HO, H1 = cut shorter than 25 mm or slightly higher than 50 mm.

Each plot was split for four sward types: one each of the three species in monoculture, and one a mixture of the three.

Treatments were applied for two full seasons. At each harvesting, herbage was cut with a pre-set 910 mm sickle-bar mower. The mixed-sward yield was sorted by hand into the three components and the harvested herbage was dried at 90 °C and its mass measured.

The most important result was that by the third season virtually no yield was recorded for clover in the mixed plots. It can be concluded that no treatment materially affected clover survival in the mixed swards, although in previous years yield of clover in the mixture was affected by treatments. In the pure swards, clover was affected by all factors although the clover survived poorly in the pure swards in any case. In the absence of both K and P, clover yields were lower than when either or both K and P were given (mean yield 29,7 g/plot). Yields were nearly trebled by the application of nitrogen at the higher level $P<0{,}001$). Cutting low and frequently in the previous seasons caused yields to be more than halved in comparison with swards cut either infrequently or high ($P<0{,}05$).

The observations suggest that the mixture will change according to treatment applied. Paspalum responded to N and K; mshiki responded to infrequent cutting and to N. Hence, to enable dominance in mixed swards to pass to:
(a) mshiki, give N and defoliate infrequently;
(b) ladino, give P and K but no N; defoliate frequently;

(c) Paspalum, give N and K; defoliate frequently (discourages mshiki) and give no P (discourages clover).

The favourable effect of K on pure clover was the only significant response to this treatment, neither of the grasses being affected by it. Pure swards of both grass species responded strongly to nitrogen. Total yields for the season showed similar effects, nitrogen being the only treatment which affected yields of pure grass stands, apart from a small increase in total Paspalum yield due to phosphate ($P<0,05$).

In the mixed swards, both grasses responded to N, but interaction between N and Q (cutting frequency) showed up. Neither grass reponded to cutting frequency at the low level of N. On the other hand, with nitrogen at the upper level Paspalum was favourably affected by frequent cutting of the sward and mshiki by infrequent high cutting ($P<0,01$), as shown in Table 1. The inference is clear that mshiki can be best controlled in swards which are not nitrogen-deficient, and defoliated frequently.

TABLE 1 — Dry-matter yields (in g/plot) in spring of 3rd season as affected by cutting frequency in previous seasons; nitrogen applied at upper level; mixed swards

Cutting frequency	Paspalum	Mshiki
3 weeks	162,2	51,4
6 weeks	90,1	143,0
S.E.	10,2	11,8

The potentially most interesting factors for control of botanical composition of mixtures appear to be nitrogen and frequency of defoliation; P and K may be useful as reinforcing factors.

The main inference is that pastures should be grazed every three weeks rather than every six to discourage 'mshiki'. Furthermore if N is withheld while P and K are applied, then the clover may persist better.

N-Ce.98/8: COMPETITION IN GRASS ASSOCIATIONS: EFFECT OF GRAZING ON RELATIVE AGGRESSIVENESS OF TWO GRASSES. 1969-1974

R.I. Jones

A common problem with perennial pastures in the Natal midlands is the invasion of pioneer grasses, collectively known as 'mshiki' (principally *Eragrostis plana*). Selective grazing commonly causes the pasture grass to be more severely defoliated than the 'mshiki', but by grazing lightly and then mowing, all plants can be reduced to about the same height. A grazing trial was laid out on a severely degenerated pasture of *Paspalum dilatatum* to measure the effects of grazing and mowing on the botanical composition of the sward. Annual fertilizer dressings amounted to 250 kg N, 150 kg P, and 220 kg K per ha.

Grazing intensity and frequency of mowing were planned to be as follows:

AO = 'mshiki' (and therefore Paspalum) grazed as short as possible.

A1 = Paspalum grazed lightly (50 - 100 mm of stubble), hence mshiki grazed very lightly.

DO = pasture mown after each grazing.

Dl = pasture mown twice during the season (Nov./Dec., Jan./Feb.) and cleaned off in winter.

The experiment was started in November 1968. In January 1972, because the treatments were not having different effects, the A treatment (grazing intensity) was replaced by two grazing frequencies, the plots being re-randomized. In the new treatments, plots were grazed for two or four consecutive days in a rotation of either 20 (FO) or 40 (F1) days, respectively, to test the theory that less frequent defoliation favours mshiki. The mowing (D) treatment was retained.

The only measure of treatment effects was an annual botanical analysis. Paspalum and mshiki and the total, were statistically analysed, as well as the annual mean relative rates of change of Paspalum (P), mshiki (M), and the ratio P/M. The variate of greatest interest was planned to be the mean relative rate of change of ℓn (P/M), denoted b_{PH}, since this measures the relative aggressiveness of the two species.

First phase:

The first botanical analysis was done in January 1969 shortly after the treatments were applied for the first time. No effect of treatments was found. However, large differences existed between replications, and a strong negative correlation ($r = -0,71$, $P<0,001$) was found between the two grass populations taken plot by plot over the whole experiment. This negative correlation implies that the two grass populations tend to be mutually exclusive, i.e. one increases at the expense of the other.

The 1972 analysis showed that frequent mowing (D0) had increased the Paspalum cover (19,6% ± 0,68%) compared to that in the plots mown infrequently (17,1% ± 0,68) and lenient grazing plus frequent mowing (A1D0) gave a lower mshiki cover (5,2% ± 0,76%) than where grazing was not lenient or mowing not regular (7,0% ± 0,44%). There was no detectable effect of treatments on total basal cover. Differences between replications remained large.

The mean aggressiveness, b_{PM} , of Paspalum relative to 'mshiki' in the first phase was not significantly affected by treatments. The mean annual rate of 0,228 ± 0,126 shows, however, that in the experiment as a whole a rapid overall improvement in botanical composition took place, and it was found that the weakest plots improved fastest. The improvement in the P/M ratio with time was mainly the result of an increase in P, more so where the Paspalum population was strongly correlated ($r = 0{,}974$, $P < 0{,}001$) with initial (1969) population.

No evidence was found of a relationship between changes in the 'mshiki' population and initial cover. Nevertheless, the observed improvement in the ratio P/M was to some extent due to a drop in M (mshiki cover), the mean annual rate of decrease being 0,063 ± 0,0069, or about 6%. It was also found that relative shifts in the two populations (P and M) were correlated ($r = 0{,}747$, $P< 0{,}001$). Plots initially with sparse Paspalum cover subsequently showed the greatest improvement in this respect, and associated with this was a fairly small decrease in the mshiki cover. On the other hand, plots with a large initial cover of Paspalum showed little increase in this grass, and a big drop in mshiki.

One of the few instances in which treatment effects were measurable was in the mean annual relative rate of change of the 'mshiki' cover, which declined in the A1D0 plots (lenient grazing, frequent mowing) significantly faster than in any other treatment.

Second phase

From 1972 to 1974, no significant effects of treatments could be detected on the relative rate of change of either grass, or the ratio P/M. The Paspalum cover continued to increase overall, although there was a tendency for it rather to decrease in the F1D1 treatment (infrequent grazing, irregular mowing). Despite this lack of a clear effect of treatments on rate of change, there was a final difference ($P<0{,}01$) in Paspalum cover between treatments: both regular mowing and more frequent grazing (20-day vs. 40-day rotation) improved the final cover of Paspalum, and the effects of the two treatments were additive so the cover ranged from 15,1% (F1D1) to 25,3% (F0D0).

In the end, a significant ($P<0{,}05$) effect of the mowing treatment on the mshiki cover was found, mean basal cover of mshiki being 8,8% and 10,5% (S.E. = 0.52%) in the plots mown regularly and occasionally, respectively.

As a result of the effects of treatments on the two populations separately, there were considerable differences ($P<0{,}01$) in botanical composition between swards at the end of the experiment, the ratio P/M ranging from 1,4 (F1D1) to 3,0 (F0D0).

In conclusion it can be stated that the desired difference in grazing intensity between treatments was not consistently obtainable and little effect of the treatment was observed. Therefore, since the mowing treatment would have offset the bad effects of the selective grazing treatment, the mowing also had little effect. Nevertheless, the mshiki was suppressed significantly more by lenient grazing plus regular mowing. The whole experimental area showed a marked improvement in botanical composition, ascribable to proper fertilization and the mere fact that it was being grazed systematically. Improvement was greatest in the weakest plots, implying that even a badly run-down pasture can be rejuvenated simply by treating it properly. There is no need to re-establish the pasture, and so the economic problems of re-establishment — cost, risk of failure, and loss of grazing during re-establishment — can be avoided.

The second phase of the experiment showed that short intervals between grazings (20-day cycle), and removal of ungrazed material immediately after grazing, are both beneficial to the Paspalum and harmful to the mshiki. A general observation was that much can be achieved by keeping the fertility status of the pasture at an adequate level.

N-Ce.98/9: COMPETITION IN GRASS ASSOCIATIONS: EFFECT OF PLANT DENSITY ON AGGRESSIVENESS. 1968-1971

R.I. Jones

In several field experiments where the effect of treatments (e.g. cutting) on the changing relationship between plant species was examined, it was implicitly assumed that plant density has no effect on the competitive relationship. An experiment was therefore undertaken to examine the effect of density.

The two grass species *Paspalum dilatatum* and *Eragrostis plana* (mshiki) were planted in large boxes kept in the open. The boxes were filled with good topsoil and well fertilized with lime, phosphate, and potash. In each box were planted 9, 36, 144, or 576 plants (D1, D2, D3, D4, respectively). Each density was sown at four different ratios (seedlings) of Paspalum (P) to mshiki (M), namely R1 = 1:8, R2 = 1:2, R3 = 2:1, R4 = 8:1. At harvest, all plants were cut to a height of about 50 mm, and the herbage was dried at 90 °C and its mass measured.

The design was a 4 x 4 random layout in two replications, without blocking, giving 15 degrees of freedom for treatments, and 16 for error, a total of 31. The total dry-matter yield over all four harvests, of each species and of their sum, as well as various ratios between species yields, were analysed. The coefficients of variation were high, the smallest being 14% for total dry-matter yield.

The natural logarithm (*ln*) of yield ratios, taking the sum of yields over all four cuts, showed significant effects of planting ratio and of plant density. The change in the value of ln (P/M) from 12/2/69 to 26/1/70 is denoted by b. The mean value of b was -1,02 ± 0,270, which is significantly less than zero. This means that mshiki was aggressive relative to the Paspalum. What is more — and it is the object of the experiment to investigate this —, there was no detectable effect of plant density on relative aggressiveness between the two species, neither did planting ratio have an effect.

The conclusion is straightforward: within the limits of experimental error — unfortunately, these were high — plant density had no effect on the relative aggressiveness of the two species investigated. The implicit assumption made to this effect in experiments concerning botanical change, is therefore not without foundation.

NUTRITIONAL VALUE

N-Ce.105/5: FEEDING OF SHEEP ON ARTIFICIAL PASTURES IN THE NATAL MISTBELT: RELATIONSHIP BETWEEN ANIMAL PRODUCTION AND THE CHEMICAL COMPOSITION OF ACCEPTABLE AND UNACCEPTABLE MECHANICALLY HARVESTED KIKUYU GRASS. 1974-1978

J.P. Marais

During the growing season at Cedara a comparison was made between the chemical composition of kikuyu which is readily eaten by sheep and kikuyu which is avoided by these animals. In a feeding experiment with South African Mutton Merino wethers, the effect of these grasses on intake, digestibility, rate of passage, rumen pH, rumen ammonia and volatile fatty-acid content, was investigated in an attempt to find a relationship between the chemical composition of kikuyu and the observed differences in palatability which may lead to poor animal production on these pastures.

The difference in acceptability observed in the field did not show up in the parameters investigated. No significant difference was observed in dry-matter intake, digestibility and rate of passage of feed through the gut between animals fed on dried kikuyu harvested from both acceptable and unacceptable areas. The difference observed in the field has therefore either been destroyed by cutting and drying the kikuyu, or selection by the animal has been reduced by pen-feeding.

The high mineral level, and especially the high nitrogen content, of the soil in the area where the kikuyu was less palatable, was reflected in the mineral status of the plant characterised by high nitrate and non-protein organic nitrogen levels. The high nitrate and non-protein organic nitrogen levels were in turn correlated with high ammonia levels and high pH conditions in the rumen.

The animals sometimes ingested kikuyu containing theoretically toxic quantities of nitrate without any apparent detrimental effect. An adverse Ca/P balance existed in kikuyu from both areas and could be aggravated by the presence of oxalate in the plant material.

VELD

FERTILIZERS

N-Ce.121/3: VELD FERTILIZATION IN NATAL: EFFECT OF FERTILIZER ON THE PRODUCTIVITY OF VELD AT KOKSTAD. 1971-1976

L.B. Symonds, G.M. Brockett and N.N. Gray

The project was started at the Kokstad Research Station in 1971/72 to measure the effect of fertilization on the dry matter yield of natural veld.

Three levels of phosphate (0,19 and 38 kg P/ha) were applied in spring and four levels of nitrogen in the form of urea were applied in two split dressings, one in spring and the other in mid-summer. The total N dressings were 0,69,138 and 207 kg N/ha per season. Potash fertilization was not applied as the levels of K in the soil concerned (Doveton soil series) was high and furthermore, only limited response of veld to K fertilization has been noted in the literature.

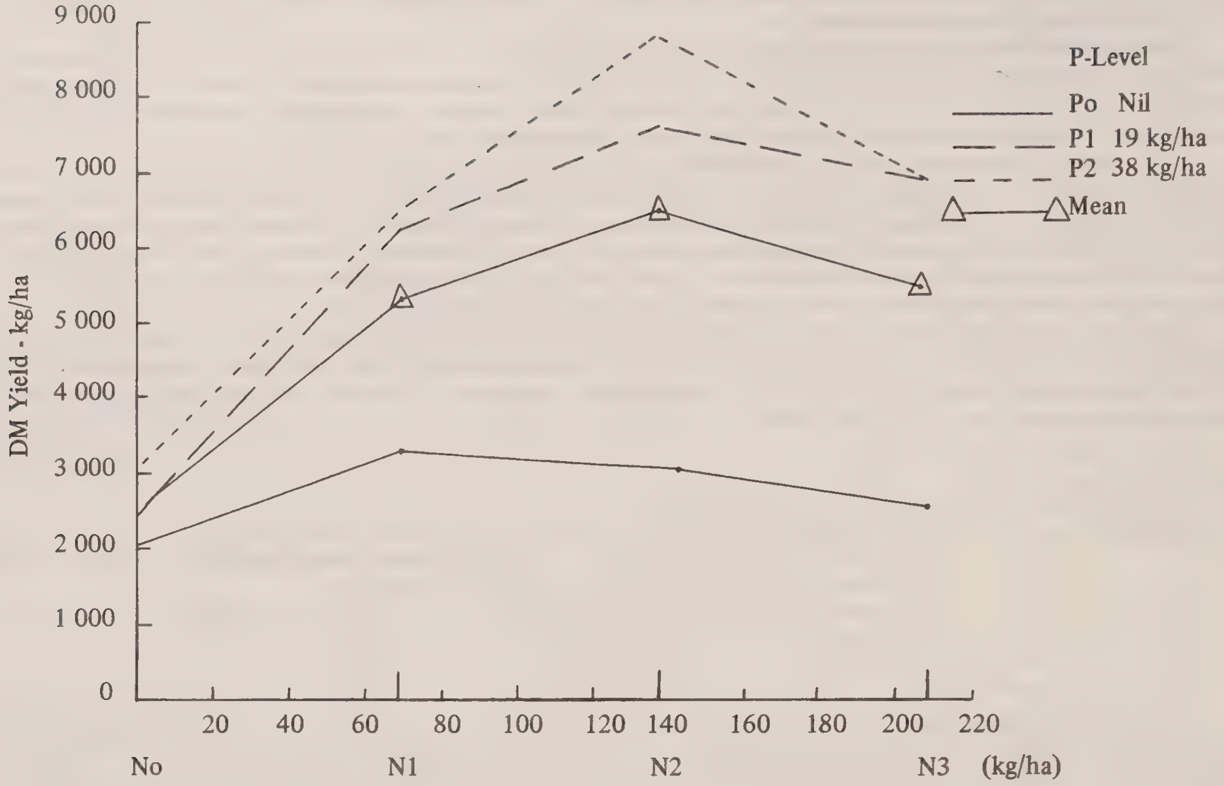

FIG. 1 - The mean response of veld to applications of N at varying levels of P

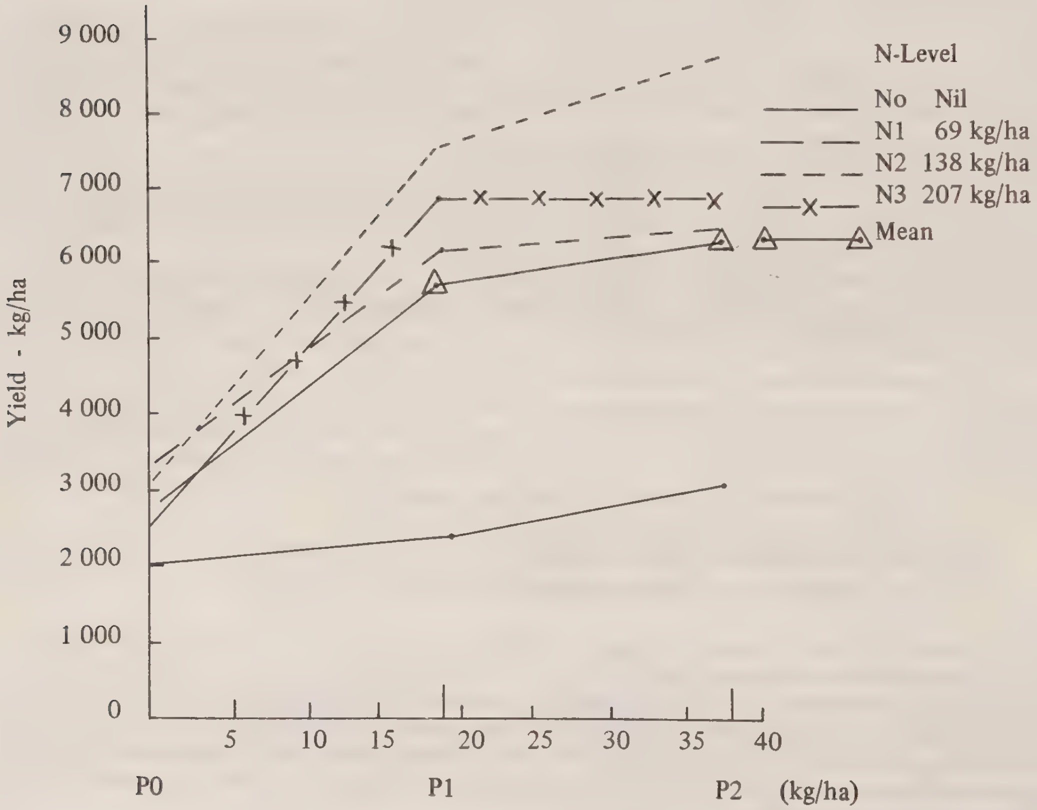

FIG. 2 - The mean response of veld to applications of P at varying levels of N

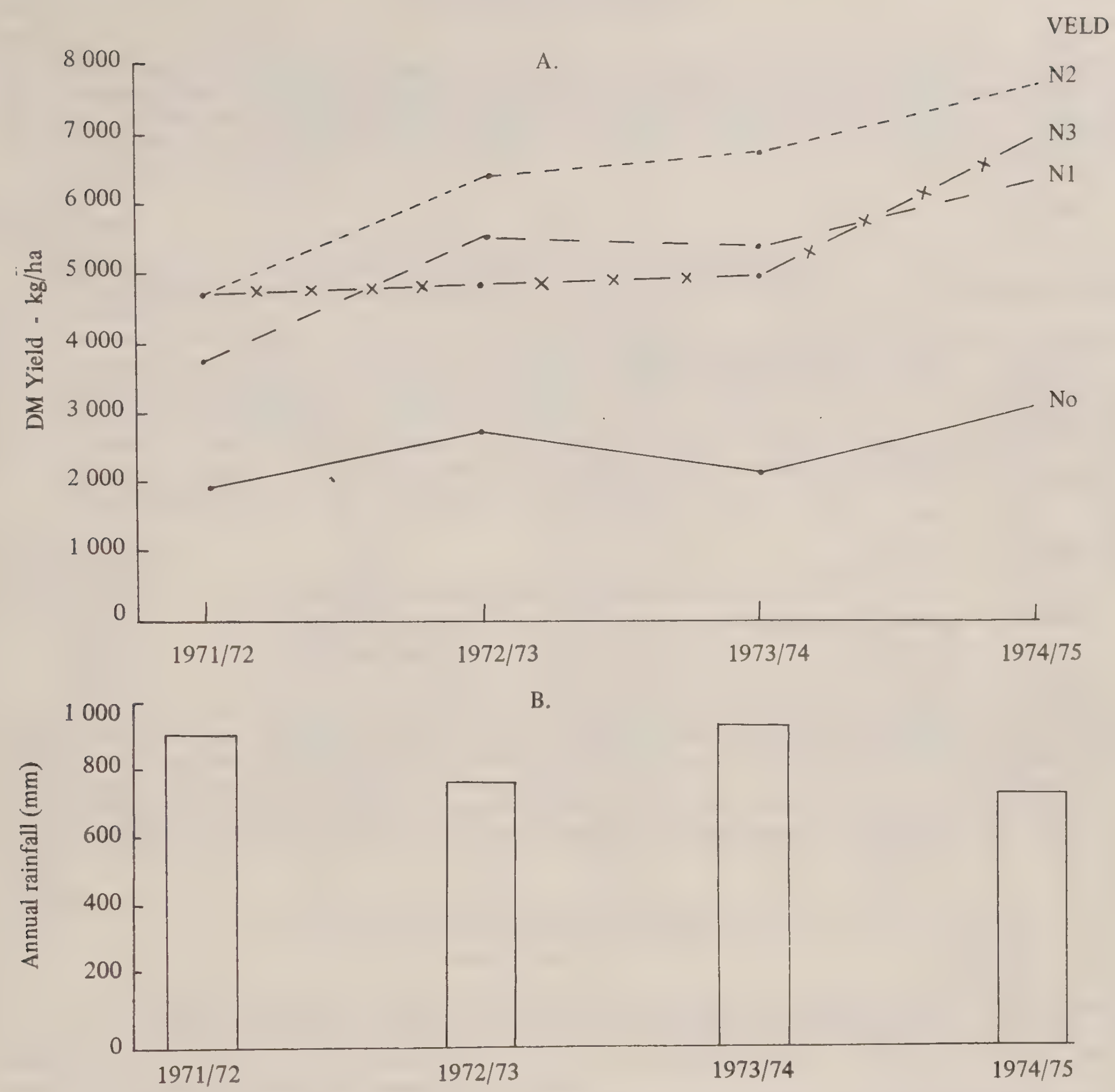

FIG. 3 - A. Seasonal variation in yield of veld at various levels of N fertilization and over all levels of P

B. Total annual rainfall for the period 1971 - 1975

TABLE 1 - Mean response of veld to various levels of N and P over four seasons

P	N0	N1	N2	N3	Mean
PO	2090	3302	3107	2596	2774
P1	2406	6199	7583	6888	5769
P2	3092	6455	8786	6882	6304
Mean	2529	5319	6492	5455	4949

This reponse is also illustrated in Figures 1 and 2.

Response to nitrogen:

The mean response to N over all levels of P reaches a peak at the N2 level and then tails off at the N3 level of nitrogen. The increase from N0 to N1 is substantial, while from N1 to N2 there is a decline in the response to applied N. At the P0 level of phosphate the response to applied N becomes negative after the N1 level of nitrogen application. According to Fig. 1 maximum DM yield occurs at N2P2.

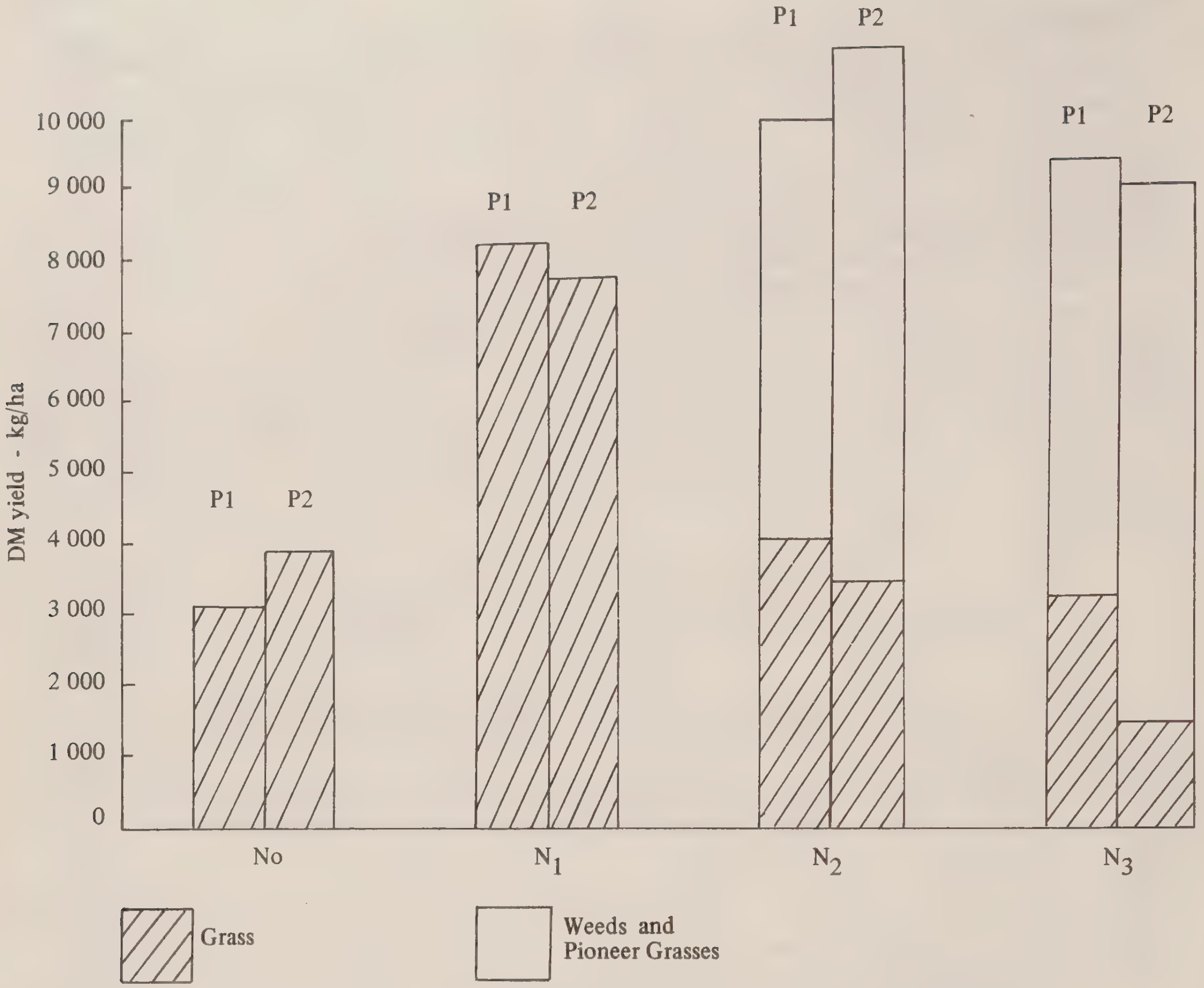

FIG. 4 - Dry matter yield of veld grass and weeds at various levels of N and P for 1974/75

Response to phosphate

The response to applications of P is illustrated in Fig. 2. Dry matter yield continues to increase with increased levels of P application. The response, however, tails off markedly after the P1 level except in the case of the N2 P2 treatment which increases by a further 1 203 kg DM/ha. The reduced response generally evident at high levels of N and P is probably due to the inability of the vegetation to respond to these high levels of fertilizer.

Seasonal variation in DM yield

Seasonal variation in yield at four levels of N and meaned over all levels of P is shown in Fig. 3.

There was a definite but gradual increase in DM yield at all levels of N over the four years of the trial. This increase can be attributed to the gradual invasion of pioneer grasses and weeds into the fertilized veld. These pioneer species are able to respond to higher levels of N and P. The variation in annual rainfall as shown in section (B) of Fig. 3 appears to have caused some variation in annual DM yield at almost all levels of N.

Botanical change:

Fig. 4 illustrates the botanical composition of the sward in the final year of the trial.

More than 60% of the total yield at the N2 and N3 levels of nitrogen is made up of pioneer grasses and weeds. This would explain the improved response at higher levels of N. It is interesting to note that this change can take place within a matter of 3 to 4 years. The invasion by pioneer grasses, in this case *Eragrostis curvula* and *E. plana*, is largely responsible for the increase in carrying capacity of fertilized veld, but at the same time is also responsible for the decline in individual animal performance normally experienced on fertilized veld.

Conclusions:

From the results of this trial the following conclusions can be drawn:

(a) Veld fertilization with N and P can substantially increase DM yields, which in turn increase carrying capacity.

(b) Veld fertilization results in a gradual invasion by pioneer grasses and weeds which in turn respond to the higher fertility and are largely responsible for the improved DM yields observed.

(c) The invasion by pioneer species at higher levels of fertility result in a sward of lower palatability and ultimately reduced individual animal performance.

(d) In order to avoid this drop in sward quality it is necessary to introduce improved pasture species which are adapted to local conditions. The selection and evaluation of such species is a most important aspect of any veld improvement research programme.

MANAGEMENT

K-Kn.4/1: EFFECT OF GRAZING *BOESMANGRAS* VELD DURING SPECIFIC SEASONS. 1965-1970

J.A. van den Berg

The effect of grazing on typical *Stipagrostis* veld at specific seasons of the year (spring, summer, late summer (autumn) and winter) in 32 plots of 0,43 ha each was investigated. Each season was of three months duration with spring commencing on 1 August. Annual wheel-point surveys (line-point) were undertaken to determine the basal cover of the vegetation.

The effect of summer grazing was found to diminish the basal cover of both *Stipagrostis ciliata* and S. obtusa whilst the effect of winter grazing was to increase the basal cover of *S. ciliata*.

K-Kn.4/2: REACTION OF *VLAKTE-BOSSIEVELD* TO GRAZING DURING SPECIFIC SEASONS. 1965-1970

J.A. van den Berg

The effect of grazing on the condition of Arid Karoo veld (Acocks veld type 29) at specific seasons of the year was investigated at the Carnarvon Research Station using 32 plots, each 0,43 ha in size. The seasons in question were spring, summer, late summer (autumn) and winter. The duration of each season was three months with spring commencing on 1 August.

It was found that grazing during the active growing season is deleterious to grass. The effect of grazing on the dwarf-shrub component in general was eliminated by the climate (rain). However, in the case of the shrub *Eriocephalus spinescens*, grazing in spring and winter had a significant diminishing effect on the cover of this species, whereas the combination of spring and winter grazing resulted in an increase of its cover.

Reference:

Acocks, J.P.H., 1975. Veld Types of South Africa. *Mem. bot. Surv. S. Afr.* No. 40.

K-Vl.14/1: FACTORS INFLUENCING CATTLE RANCHING IN THE EASTERN KAROO. 1972-1976

C.A. du Toit

The advisability of introducing cattle farming to parts of the Eastern Karoo where the annual rainfall averages 375 mm and more, and where a good perennial grass component can ultimately be developed, gave rise to an investigation into the following aspects:

- The number of sheep that consume the equivalent one large stock unit or adult Hereford beast
- The correct proportion of sheep to cattle in the grazing herd i.e. sheep/cattle ratio
- The long-term carrying capacity of the veld

These investigations were conducted on a farm in the Albert (Burgersdorp) district, in seven adjacent grazing camps, each two hectares in area and supplied with suitable stock watering points. The soil in these camps is of the Valsriver form, Lindley series and the veld type Dry Cymbopogon-Themeda (Acocks veld type No. 50). The vegetation is fairly homogeneous.

The seven camps were grazed simultaneously according to the following schedule based on the three camp system for sweetgrass veld:

First year	: Early summer - November to January Winter 2 - July and August
Second year	: Late summer - February to April
Third year	: Spring - September and October Winter 1 - May and June
Fourth year	: As for lst year etc. etc.

Merino sheep and Hereford cattle (older than two-tooth and not in calf) were used for grazing these camps and the experiment resulted in an increase of good permanent grass cover.

Camp No.	Animals	Stocking rate (ha/SSU)*	Factor (SSU/LSU)*	% Increase in basal cover
1	16 sheep	0,75	8	12,6
2	8 sheep	1,50	4	25,8
3	2 cattle	1,00	-	21,0
4	12 sheep	1,00	6	15,0

The above results were obtained during a period of most favourable rainfall so that in spite of poor treatment of Camp 1, an increase of 12,6% of basal cover was still shown in respect of perennial climax and sub-climax grasses, such as *Themeda triandra, Tetrachne dregei, Digitaria ariantha, Sporobolus fimbriatus* and *Cymbopogon* plurinodis. Camps 2 and 3 had marked increases of 25,8 and 21,0% respectively.

Although this project is not biometrically sound, it would appear that the conversion factor tends definitely more to four sheep equating a large stock unit than to the generally accepted number of six sheep.

In order to determine the most advisable sheep/cattle ratio, certain camps were grazed with both sheep and cattle; the consequent improvement in veld condition is given in the following table:

Camp No.	Animals	Stocking rate (ha/SSU)*	Sheep/cattle ratio	% Increase in basal cover
3	2 cattle	1	0:0	12,0
4	12 sheep, 2 cattle	1	0:0	8,0
5	12 sheep, 2 cattle	1	6:1	20,6
6	18 sheep, 1 cattle	1	18:1	10,2
7	6 sheep, 3 cattle	1	2:1	17,2

*SSU = Small stock unit i.e. 1 merino sheep
LSU = Large stock unit i.e. 1 Hereford (2 tooth)

It is worthy of note that camps 5 and 7 with their narrower sheep:cattle ratios of 6:1 and 2:1 respectively, showed the highest increase in grass cover, namely 20,6% and 17,2% in comparison with camps 4 and 6 where the ratios were wider. It was concluded that the ideal sheep : cattle ratio is between 6:1 and 2:1, depending on the rainfall, thus leaving a fairly large field for manipulation to the practical farmer.

The experiment shows that in the long term a stocking rate of one hectare per small stock unit can safely be accepted because at this rate percentage increases in basal grass cover were of the order 8,0 to 20,6%. Furthermore, it would appear that provided cattle are included in the grazing rotation, Merino sheep are not as harmful to the veld as is generally assumed.

References:

Acocks, J.P.H., 1975. Veld Types of South Africa. *Mem. bot. Surv. S. Afr.* No. 40
MacVicar, C.N. *et al.*, 1977. Soil Classification. *Sci. Bull. Dept. Agr. Tech. Serv. S. Afr.* No. 390

N-Ko.7/3:

VELD MANAGEMENT STUDIES IN EAST GRIQUALAND: AN INVESTIGATION INTO THE EFFECTS OF WINTER UTILIZATION OF SUMMER-SPARED SOURVELD. 1971-1975

R.H. Drewes and N. Gray

The object of this trial conducted at the Kokstad Research Station, was to investigate the influence on subsequent regrowth of winter grazing on sourveld that had been spared during summer. The winter utilization was accompanied by various degrees of summer utilization. The (unreplicated) treatments applied, are given in Table 1.

TABLE 1 - Herbage yields obtained at the end of a full season's rest after three years' treatment (% increase or decrease on pre-treatment yield)

Treatment	Sub-treatment			Mean
	Rest entire growing season	Graze early growing season, rest late growing season	Graze throughout growing season	
1. Spring burn	+ 13%	+24%	+34%	+20%
2. Graze in April	+ 16%	+ 3%	+ 5%	+ 8%
3. Graze in May	+ 57%	+74%	+86%	+72%
4. Graze in June	+115%	+69%	+59%	+81%
5. Graze in August	+127%	+80%	+66%	+91%
6. Graze in April, May, June	+ 67%	— 3%	— 7%	+19%
7. Graze in June, July, August	+ 75%	+36%	+44%	+51%
Mean	+ 67%	+40%	+41%	+49%

Mature merino-type sheep were used in the experiment at the rate of 1 440 grazing days/ha (48 sheep/ha for one month or 16/ha for three months) in winter for three seasons. The area was rested during the fourth season, after which, at the end of the fourth summer, herbage yields were measured. These are presented in Table 1 as a percentage increase or decrease in yield over the yields measured after mowing at the end of the winter prior to the commencement of the treatments.

From the results it is apparent that:

1. Grazing during April, particularly when accompanied by summer grazing, resulted in the poorest recovery after three years.
2. Grazing from May to August would appear to be a more beneficial means of removing surplus herbage than by burning in spring after rain.
3. Better vigour is maintained in winter-grazed veld which was not utilized during the summer.

W-Nt.1/1:

VELD GRAZING STUDIES AT NORTIER EXPERIMENT FARM. THE INFLUENCE OF SEASONAL GRAZING ON THE VELD. 1965-1975

F.G.J. van der Westhuizen and J.G.V. Joubert

Short-period intensive grazing is more detrimental to the cover and composition of the Strandveld of the West Coast than less intensive grazing over a longer period at the same overall stocking rate.

The late growing season (July, August and September) is the most detrimental grazing period in the Strandveld because it is the time of the year when most edible plants flower, produce seed and store reserves in their basal stems and roots. In order to ensure optimum growth-rate of the plants and to improve the cover and composition of the veld, it is most important that the veld should be rested during this period.

VELD REPLACEMENT

N-Ce.111/20:

VELD REPLACEMENT STUDIES IN NATAL: A COMPARISON OF DIFFERENT FORMS OF RADICAL VELD IMPROVEMENT AT THE KOKSTAD RESEARCH STATION. 1973-1976

E.P. Theron, G.N. Brockett and N.N. Gray

The project was started in 1973 to evaluate under grazing five different pasture treatments representing various stages of veld reinforcement and replacement. The trial was laid out at the Kokstad Research Station, ran for two years, and consisted of the following grazing treatments:

(a) veld (control)
(b) fertilized veld (N & P were applied)
(c) fertilized veld + sod-seeded clover (N & P were applied.)
(d) *Eragrostis curvula* + N
(e) *E. curvula* + sod-seeded clover (N, P & K applied)

The treatments were rotationally grazed with 15-month-old Hereford-type cattle and weaner Merino lambs. The performance of the lambs in the first year was poor with the result that they were excluded in the second season. The levels of fertilizer applied are given in Table 1 and the mass gains of the cattle are presented in Fig. 1.

TABLE 1 - Fertilizer applied (kg/ha)

Treatment	1973/74			1974/75		
	N	P	K	N	P	K
Fertilized Veld	282	18,9	-	282	18,5	-
Fert. Veld + Clover	164	18,9	-	-	18,5	-
Eragrostis + N	155	6,6	-	118	9,1	38
Eragrostis + Clover	133	6,6	49	148	-	49

The mean average daily gain and mean starting rate for the different treatments are given in Tables 2 and 3.

TABLE 2 - Average daily gain A.D.G. of sheep and cattle and the combined mean stocking rate for five grazing treatments at the Kokstad Research Station (1973/74).

Treatment	A.D.G. (kg)		Avrg. Stocking rate
	Cattle	Sheep	*MLU/ha
Veld	0,46	-	0,71
Fertilized veld	0,59	0,20	3,30
Fert. veld + clover	0,68	0,22	2,60
Eragrostis + N	0,37	0,19	4,34
Eragrostis + clover	0,39	0,21	3,20

Grazing period - 155 days (23 Oct.-27 Mar.)
*MLU = Mature livestock units

TABLE 3 - Average daily gain, and stocking rate per hectare of cattle on five grazing treatments for 1974/75.

Treatment	Cattle A.D.G.	Avrg. stocking rate
	kg	MLU/1 ha
Veld	0,52	0,69
Fertilized veld	0,52	2,14
Fert. veld + clover	0,72	1,48
Eragrostis + N	0,51	1,42
Eragrostis + clover	0,53	1,48

*MLU = Mature livestock units

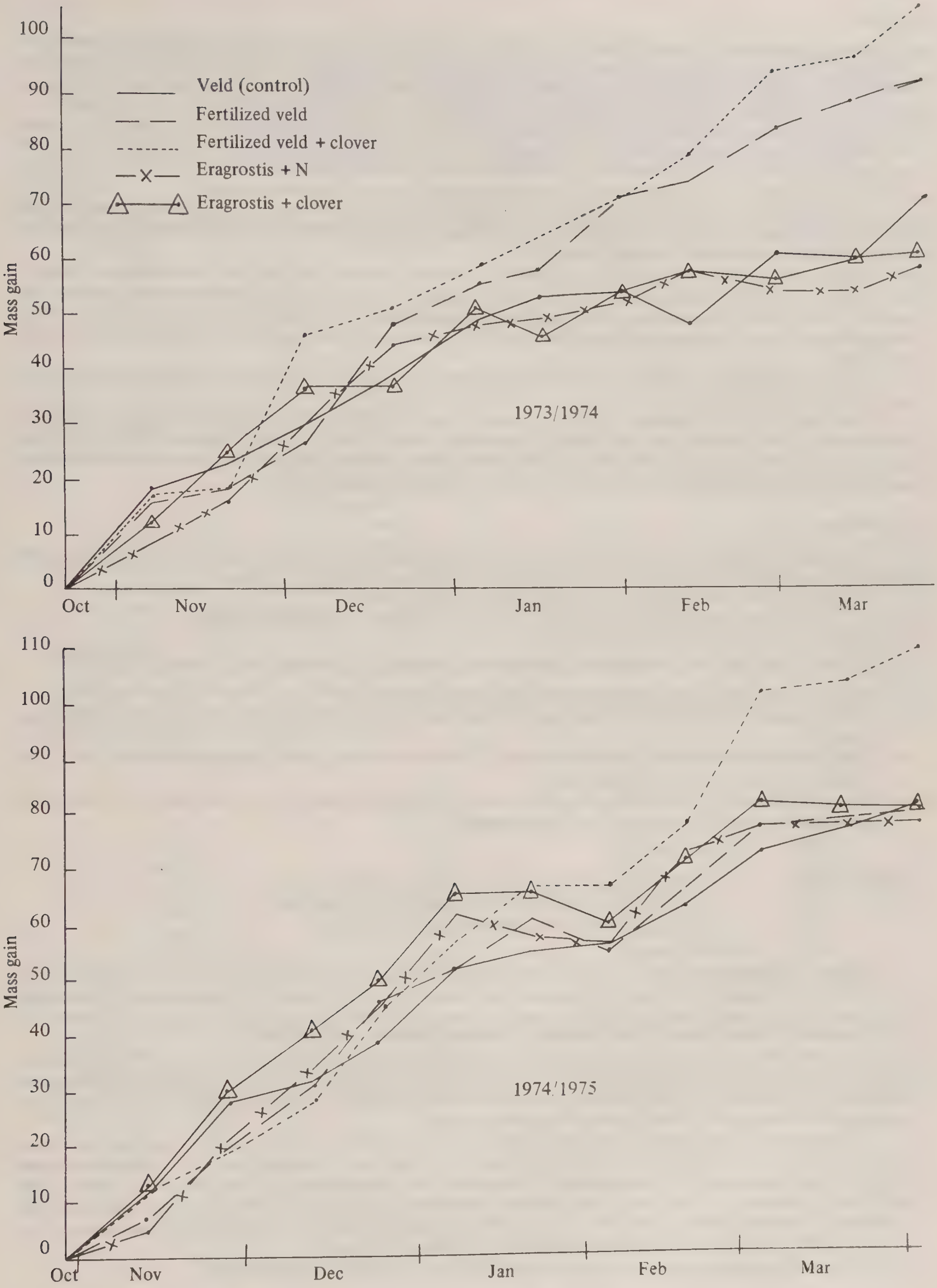

FIG. 1 - Mass gain of tester cattle on summer veld and veld in various stages of reinforcement and replacement

The performance of the cattle on the veld-only treatment was in keeping with previous results and exhibited a typical drop in growth rate over the January/early February period. Growth on the veld was better in the second season which was characterised by a lower rainfall - 740 mm as opposed to 935 mm in 1973/74. This drop in animal performance in a wet year has been observed in other trials at Kokstad.

Half the area of fertilized veld had been fertilized for some years and had retrogressed to a stage where most of the pasture consisted of *E. curvula* and *E. plana*. The performance of the cattle in the first year was better than in the second year. The decline in the second year is attributed to the lower stocking rate applied in 1974/75 and the consequent accumulation of rank and mature herbage.

The fertilized veld plus clover area had a similar history to that of the previous treatment except that clover was introduced. The clover established well in this treatment resulting in good animal performance. (cf. Fig. 1) and a reasonable carrying capacity.

The *E. curvula* plus N treatment was sited on an existing pasture and fertilized according to Table 1. The levels of N applied were far too low to produce quality material and they varied between seasons. In the first year, with the leaching effect of the high rainfall, rank-mature herbage of low qulaity accumulated, resulting in poor cattle growth rate. The stocking rate was, however, reasonably high at 4,34 MLU/ha.

In the second season the lower rainfall and possibly the lower stocking rate improved growth rate, but stocking rate declined.

The clover in the *E. curvula* + clover treatment, never established successfully and consequently the performance of the animals was only slightly better than those on the previous treatment. Nitrogen levels again varied between seasons. The soil series on which this treatment was established was poorly drained and had poor physical properties, making it difficult to establish the pasture.

Conclusions

There are a number of factors which contribute to the variability of the results of this trial and make it difficult to draw valid conclusions. These factors may be summarized as follows:

(a) variation in soil series over the treatments (four different series)
(b) variation in amounts of fertilizer applied between treatments and between seasons
(c) absence of replication of treatments and
(d) absence of well defined management variables to eliminate the confounding effect of management.

It is, however, possible to emphasize certain aspects of this trial:

(a) The inclusion of a legume in a grass pasture improves animal performance and will ultimately reduce costs.
(b) Low levels of N applied to a grass such as *E. curvula* do not improve animal performance over that of veld, but may improve stocking rate.
(c) It is important not to allow an excessive build-up of mature material in *E. curvula* or *E. plana* type pastures if animal performance is to be maintained.

W-Sb.96/2(K): RECLAMATION AND IMPROVEMENT OF MOUNTAIN-RENOSTERBOS VELD. 1966-1975

F.G.R. van der Westhuizèn and C.J.Pienaar

Mountain-Renosterbos veld (Acocks Veld Type No. 43)) is a semi-arid scrub veld dominated by unpalatable *Elytropappus rhinocerotis* (renosterbos), occurring in the South-Western Karoo. A relatively small proportion is arable and most of it therefore can only be used for grazing, however, as a result of the dominance of unpalatable *E. rhinocerotis* it is virtually useless as a pasture.

An experiment was carried out to reclaim the veld by applying bush-cutter and fire treatments as well as by oversowing with *Eragrostis curvula* and Ehrharta calycina. No grazing was allowed and all treatments were applied during both the autumn and spring while there were also control plots that received no treatment other than protection against grazing.

A randomised block design with split plots and three replications was used. Plant surveys were carried out in the spring to determine changes in cover and composition. *E. rhinocerotis* and *Dimorphotheca cuneata* (both unpalatable) dominated the composition of the veld. The former was significantly reduced ($p = 0,05$) in all the different treatments showing that control by bush-cutting as well as burning is possible. After a year or two however, the weed population started to increase again, with the most rapid re-population occurring in the spring burning treatment.

D. cuneata populations also decreased significantly ($p = 0,05$) in all treatments.

Small quantities of the valuable palatable perennial grass *Ehrharta calycina* appeared in all the treated plots as well as in the control plots probably as a result of the protection against grazing. There was no significant reaction to oversowing of either *Eragrostis curvula* or *Ehrharta calycina*.

There was a significant increase in cover of the valuable and palatable karroo bush, *Eriocephalus ericoides*, (kapokbos) in the control plots.After nine years the veld in the control plots which had received no radical treatment but were simply protected against grazing, showed the greatest improvement.

Reference:

Acocks, J.P.H. 1975. Veld Types of South Africa. *Mem. Bot. Surv. S. Afr.* No. 40. Govt. Printer, Pretoria.

Plantation Crops

COFFEE

CULTIVARS

(S)N.79/5: COFFEE CULTIVARS IN THE TRANSVAAL LOWVELD. 1965-1977

K. de Rooster

The aim of the project was to compare the performance and yield of 13 coffee cultivars under South African conditions (at Friendenheim near Nelspruit) in order to determine which would be the best for commerical planting: Mundo Novo, K-7, Mibirizi, Local Bronze, Typica Sumatra, Rumangabo, KE-20, SL-6, Bourbon, Blue Mountain Jamaica, Kiepersol Local, SL-28, and Caturra.

The trial was planted in October 1965 in a randomized block arrangement with 5 replications and 20 trees per plot.

During the first two seasons the growth of the young trees was retarded by low winter temperatures. During subsequent seasons low winter temperatures retarded fruit ripening and resulted in the crops being harvested late. Coffee-rust, caused by the fungus *Hemileia vastatrix*, required annual spraying and it reduced the total yield of the trees.

The following average yields which are regarded as reasonable were nevertheless recorded:

Cultivar	Yield (kg/ha)	Cultivar	Yield (kg/ha)
SL 28	1 356	Kiepersol local	905
Mibirizi	1 160	SL 6	827
KE 20	1 146	K7	738
Bourbon 72	1 142	Local Bourbon	711
Caturra	1 039	Mundo Novo	647
Rumangabo	1 043	Typica Sumatra	630
Blue Mountain Jamaica	954		

The cultivar SL 28 gave the best yield and can be recommended for commercial coffee planting in South Africa.

At the present (1977) high price of R3 000 per ton for coffee, a yield of 1,36 tons per hectare gives a gross income of R4 068 which is a very high income and makes coffee-growing a profitable enterprise in suitable areas in South Africa.

ANIMAL PRODUCTION

Farm Animals

CATTLE

BEEF PRODUCTION

(A)VS-Pr.13/4: INVESTIGATION INTO POSSIBLE BREED: FEED INTERACTION IN DAIRY CALVES, DUAL-PURPOSE X DAIRY CALVES, AND BEEF X DAIRY CALVES ON LIBERAL AND LIMITED MILK-FEEDING REGIMES. 1965-1971

R.T. Naude

Jersey and Friesland cows were inseminated with the semen of Charolais, Brown Swiss, Simmentaler and Hereford bulls. The heifer calves born were fed on four different feeding rations. In all the systems calves received whole milk at the rate of 10% of body mass for the first two weeks after birth except in the case of the skim milk system in which calves received whole and skim milk each at the rate of 5% of body mass during the second week of life. All calves received lucerne hay (0,5% of body mass) from the fourth week onwards.:

In the first system (skim milk) calves received skim milk (10% body mass) for 14 weeks, following on the initial two week period as described above, and were supplemented with maize meal and wheaten bran (*ad lib*) for 16 weeks.

In the second system whole milk was fed for the first 8 weeks at the rate of 10% of body mass and for the next 4 weeks (up to 12 weeks of age) at 5% of body mass. The ration was supplemented with maize meal and bran for the first 8 weeks and with a starter meal for the second 8 weeks.

In the third starter system, calves were fed whole milk (10% of body mass) for the first 4 weeks, 5% of body mass for the second 4 weeks and this was supplemented with a starter meal for 16 weeks.

In the fourth (early-weaning) system calves received whole milk at the rate of 10% of body mass for the first two weeks followed by 5% for the next two weeks, and were supplemented with a starter meal for 16 weeks. All calves were slaughtered at 16 weeks of age.

It was found that during the first 8 weeks of life calves fed the whole-milk ration had the highest rate of growth, which was statistically more rapid ($P<0,05$) than that of those on the skim-milk and early-weaning systems. Charolais-type calves performed best during the second eight weeks of life when raised according to the early-weaning system. A finding which should be borne in mind when raising Jersey crossbred calves is that when compared with the Friesland-type cows on a skim milk ration they had the poorest growth rate. Jersey-type calves should, therefore, be raised on the cheapest of the remaining three rations which resulted in similar calf growth rates. Friesland-type calves did not perform satisfactorily on the early-weaning system. The early-weaning system resulted in poorer feed-conversion ratios than was the case for the whole milk and calf starter systems. In contrast to the favourable growth and feed-conversion performance of Charolais and Simmentaler-sired calves, Brown Swiss-sired calves, that is Brown Swiss x Jersey calves fed the skim milk ration, performed the poorest of all types studied. Particularly Brown Swiss X Jersey calves, fed the skim-milk ration.

As a result of higher relative masses of skin and empty digestive tract of Jersey-type calves, these also had lower dressing percentages (52,92%) in comparison with Friesland-type calves (55,22%). Jersey-type carcases had poorer muscle to bone ratios than Friesland-types and although Simmentaler-type calves had heavier bones than the other three sire-types, these calves also had the best developed muscles of all types tested. An interesting finding was that Jersey-type calves had similar ratios of hind to fore quarters to Friesland-type calves. With regard to the influence of rations on the fat-level of calves, it was found that calves fed whole milk were fatter than those fed skim milk.

Charolaise and Simmentaler-type calves exhibited the best growth and feed conversion and Jersey-type calves did not do well on a skim-milk system. The economy of rearing Jersey calves on any of the systems two to four and Friesland calves on any one of the four systems compared, should determine the choice of a system. Charolaise-sired calves had the most favourable carcass characteristics.

H-Bl.58/4: BEEF PRODUCTION FROM THE DAIRY HERD: INTENSIVE WEANER-CALF PRODUCTION FROM DAIRY COWS ON VELD. 1970-1974

J. Reyneke and M. von La Chevallerie

Repeated switch-overs by many cattle farmers from dairy to beef and back to dairy production have led to a considerable reduction in the numbers of dairy cows. An experiment was thus carried out to test the possibility of Friesland cows producing weaner calves off veld on single and double-suckling systems. At the same time the effect of creep-feeding was investigated, the performance of the calves in feedlots was tested and the reconception rate of the cows was noted.

At the Bethlehem Agricultural Research Station (28° 10'S, 28° 18'E and 681 mm mean annual rainfall) sixty in-calf Friesland cows (mated to Friesland bulls from 15 November to 31 January) were randomly divided into two main groups for a period of three years. Soon after calving, one group of 20 cows received two male Friesland calves each (double-suckling, D) whereas the other group of 40 cows received only one male calf each (single-suckling, S). Each of the main treatments (D and S) was subdivided into two further groups, one receiving creep feed (D-CF and S-CF) from the age of two months and the other (D-OCF and S-OCF) where no creep feed was available to the calves until weaning at approximately seven months of age. The creep feed was palatable and had crude protein and TDN contents of 13,2% and 77,5% respectively.

Cows and calves were grazed on summer veld (Acocks veld type 56) which can be described as being in a pioneer stage of succession with *Eragrostis plana, E. gummiflua* and *E. curvula* as the dominant species. All cows were pregnancy tested, internal and external parasites were controlled and a lick containing salt and phosphate was always available.

At weaning, four calves from each treatment group of 20 were slaughtered (group A). The remaining sixteen were split into two groups of eight each. One group was intensively fattened on a high-concentrate ration and slaughtered at 350 kg live-mass (group B). The other group was finished on a maize silage ration supplemented with maize grain at the rate of 1% of the steers' live-mass daily and was slaughtered on attaining 430 kg live-mass (group C).

TABLE 1 - Calf weaning masses, reconception of cows and their mass changes

Treatment	Weaning masses (kg)			Reconception of cows (%)			Cows mass changes (kg)		
	1970/71	1971/72	1973/74	1970/71	1971/72	1973/74	1970/71	1971/72	1973/74
S-OCF	227,2	238,0	202,9	80	81	80	-16,6	26,1	3,2
S-CF	249,6	249,3	231,1	81	74	85	30,0	17,5	-10,8
D-OCF	223,3	213,0	186,4	78	79	70	23,3	19,2	0,3
D-CF	249,7	224,3	194,8	76	78	80	23,6	-9,9	-0,1

During the 1970/71 season differences in weaning-mass between single and double-suckled calves were not statistically significant. However, during the 1971/72 and 1973/74 seasons, single-suckled calves in some cases achieved a significantly ($P<0,05$) and highly significantly ($P<0,01$) greater weaning mass compared to double-suckled calves. The effects of creep feeding were slight and significant differences were observed ($P<0,05$) in two out of three years. No consistent trend in respect of a differential response by double or single-suckled calves to creep feed was observed.

It would appear that the average Friesland cow can sustain an excellent growth rate in double-suckled calves on natural veld. The fact that creep feeding did not necessarily improve the weaning mass of double-suckled calves supports the evidence that these calves were not subjected to a significant shortage of nutrients through a lack of milk. No consistent trend was evidenced with regard to loss of mass by the suckling cows on reconception.

Calf scouring was not experienced with healthy calves sucking dams with excessive milk but presented serious problems in respect of calves brought in from surrounding dairy farms. A high percentage of cows without pigment on the teats suffered cracked teats.

The average daily creep-feed intakes ranged from 1,71 to 1,86 kg and represented an efficiency of feed conversion to additional weaning mass of 16,2 to 1 (1970/71); 16,3 to 1 (1971/72) and 15,1 to 1 (1973/74), which cannot be economically justified.

The data on the calves slaughtered at weaning (not presented in Table 2) indicated that the creep-fed calves produced carcases of a slightly better quality and with thicker back-fat covering than did their non-creep-fed counterparts. Creep feeding had no significant effect on number of days required to reach slaughter mass and neither did double-suckling as compared with single-suckling. The present study also revealed that differences brought about by treatments, with regard to several carcass characteristics which might exist at weaning, were completely dissipated during the feed-lot period. It was also apparent that the costs incurred during creep feeding were carried right through the feed-lot period and eventually reflected in lower gross margins.

TABLE 2 - Feedlot performance and carcass evaluation

	1970/71		1971/72		1973/74	
	Group B	Group C	Group B	Group C	Group B	Group C
Mean daily gain (g)						
S-OCF	975	899	1 170	1 022	1 128	942
S-CF	899	786	1 195	1 001	1 325	1 011
D-OCF	764	843	1 126	1 123	1 156	1 101
D-CF	1 035	833	1 166	1 056	1 155	1 012
Carcass mass (kg)						
S-OCF	194,5	231,7	187,6	236,7	Carcases not evaluated	
S-CF	195,2	227,0	189,4	234,3		
D-OCF	205,9	236,7	188,8	236,2		
D-CF	193,6	236,5	191,3	233,1		
Grading (out of 20 points)						
S-OCF	18,0	17,7	17,2	18,7		
S-CF	18,5	17,3	18,4	18,2		
D-OCF	16,0	17,7	16,2	17,5		
D-CF	19,0	18,3	s,917,0	18,0		

Reference:

Acocks, J.P.H., 1975. Veld Types of South Africa *Mem. Bot. Surv. S. Afr.* No. 40 Govt. Printer, Pretoria.

N-Ce.115/12: PRODUCTION AND REPRODUCTION IN BEEF CATTLE: FATTENING OF STEERS ON SUMMER PASTURES: 1974-1976

S.F. Lesch, P.E. Bartholomew,
A. van Niekerk and I. MacDonald

This experiment was initiated in order to study the effect of wintering levels and concentrate-supplementation on Kikuyu and on grass/clover pastures on the performance of weaner steers. The grass components in the second pasture were tall fescue and rye-grass. The experiment was conducted over two seasons.

During the first season Simmentaler x Hereford steers were used. On both types of pasture concentrate was supplemented at the rate of 0,0; 0,5; 1,0 and 1,75% of body mass. The concentrate consisted of 96,5% yellow maize meal, 1,5% feed-lime, (3/4/74) none of the animals was in a marketable condition and they were fed *ad lib*, on a urea-free ration containing 7,9% C.P. and 67,5 T.D.N. until ready for marketing.

The gains on pasture and in feedlot as well as the slaughter and carcass data are presented in Table 1. Increased levels of supplementation on both pastures effected increased animal gains. Rate of gain of animals on pasture had no effect on animal performance in the feedlot. Slaughter percentage, depth and area of eye muscle as well as the fat covering of the eye muscle of animals grazed on kikuyu, were less than in the case of animals grazed on grass/clover pasture. Increased supplementation effected increased depth and area of eye muscle and also resulted in more marbling in the eye muscle and fat-covering over the eye muscle.

During the second season weaner steers of a Simmentaler x (Hereford x Afrikaner) and Sussex x (Hereford x Afrikaner) type were used. Animals were grouped in 12 groups of five animals each plus an additional group, Group 13, consisting of ten animals. Groups 1, 2, 3, 7, 8 and 9 were wintered at an ADG (average daily gain) of 0,32 kg, while groups 4, 5, 6, 10, 11 and 12 were wintered at an ADG of 0,65 kg. Group 13 was wintered on rye-grass pasture. During the summer, groups 1, 2, 3, 4, 5 and 6 were grazed on kikuyu pasture while groups 7, 8, 9, 10, 11 and 12 were grazed on grass/clover pasture. On the pastures, groups 1, 4, 7 and 10 received no concentrate supplementation while groups 2, 5, 8 and 11 were

TABLE 1 - Average gains on pasture and in feedlot and slaughter and carcass data for experimental treatment during the first season

Pasture	Suppl. Level (% body mass)	Avr. Daily Gain (kg)		Slaughter per cent	Grading (20 pts)	Avr. eye-muscle measurements			Fat covering	
		Pasture	Feedlot			Width (cm)	Depth (cm)	Area (cm^2)	Eye muscle	Rib (cm)
Kikuyu	0,0	0,67	1,07	51,20	13,5	11,50	5,07	44,4	0,52	0,22
Kikuyu	0,5	0,85	1,01	51,10	13,5	12,00	5,15	47,3	0,68	0,28
Kikuyu	1,0	0,89	1,02	51,62	15,5	11,82	5,47	49,3	0,72	0,35
Kikuyu	1,75	1,14	1,05	52,41	16,5	12,38	5,77	54,1	0,72	0,38
Grass/clover	0,0	0,92	1,02	51,44	13,7	11,76	5,37	49,8	0,61	0,17
Grass/clover	0,5	0,98	1,12	53,10	16,5	12,28	5,38	52,1	0,77	0,32
Grass/clover	1,0	0,95	1,19	53,92	16,7	11,94	5,90	52,8	0,92	0,32
Grass/clover	1,75	1,10	1,15	52,42	15,5	12,03	5,68	55,4	0,77	0,28
Kikuyu		0,89	1,03	51,58	14,8	11,93	5,36	48,77	0,66	0,31
Grass/clover		0,99	1,12	52,72	15,6	12,00	5,57	52,04	0,77	0,27
Suppl. level (%)	0,0	0,78	1,04	51,32	13,6	11,63	5,19	47,1	0,57	0,19
	0,5	0,91	1,06	52,10	15,0	12,14	5,27	49,7	0,72	0,30
	1,0	0,92	1,10	52,77	16,1	11,88	5,68	51,1	0,82	0,33
	1,75	1,12	1,10	52,42	16,0	12,21	5,72	53,7	0,74	0,33

TABLE 2 - Average gains on pasture and slaughter and carcass data for experimental groups during second season

Treatment group	Avr. live mass gains (kg)				Slaughter data			Eye-muscle data				Fat covering	
	Winter		Summer		Carcass mass (kg)	Slaughter %	Grading (20 pts)	Width (cm)	Depth (cm)	Area (cm^2)	Marbling (5 pts)	Eye muscle (cm)	Rib (cm)
	Total	ADG	Total	ADG									
1	26,0	0,32	85,4	0,56	155,8	49,7	8,2	10,9	4,9	42,4	0,4	0,16	0,08
2	26,0	0,32	92,3	0,61	177,4	50,3	10,6	11,4	5,2	45,7	0,6	0,42	0,10
3	26,0	0,32	121,8	0,80	215,6	53,3	15,8	12,6	4,9	51,9	1,4	1,06	0,44
4	53,5	0,65	61,1	0,41	172,2	49,7	8,8	11,9	5,1	50,2	0, 7	0,26	0,07
5	53,5	0,65	100,7	0,4	193,2	50,6	9,4	11,9	5,6	53,8	0,9	0,42	0,10
6	53,5	0,65	113,5	0,75	228,0	53,2	16,0	12,1	5,7	54,6	2,5	1,05	0,38
7	26,0	0,32	86,2	0,57	170,4	50,7	8,8	11,4	4,3	46,4	0,3	0,42	0,12
8	26,0	0,32	120,6	0,79	196,2	51,8	15,2	11,8	5,7	51,6	0,5	0,56	0,19
9	26,0	0,32	146,0	0,96	223,4	53,1	16,4	11,9	5,4	53,4	2,1	0,68	0,20
10	53,5	0,65	73,3	0,48	182,0	52,1	11,0	11,9	5,4	50,3	0,5	0,40	0,10
11	53,5	0,65	121,8	0,80	215,0	53,5	17,4	12,3	5,7	55,8	1,3	0,58	0,20
12	53,5	0,65	120,7	0,79	231,8	54,2	17,0	12,5	7,5	59,3	1,5	0,80	0,34
13	80,6	0,98	75,6	0,50	180,2	51,3	12,2	12,2	5,9	54,0	0,7	0,30	0,15
Winter gain:		0,32	108,7	0,72	189,8	51,5	12,5	11,7	5,1	48,6	0,9	0,55	0,19
		0,65	98,5	0,65	203,7	52,2	13,5	12,1	5,8	54,0	1,2	0,58	0,20
Pasture: kikuyu			95,8	0,63	190,4	51,1	11,5	11,8	5,2	49,8	1,0	0,56	0,19
grass/clover			111,4	0,73	203,1	52,6	14,3	11,9	5,7	52,8	1,0	0,57	0,19
Suppl. Level:		0,0	79,0	0,52	170,1	50,6	9,2	11,5	4,9	47,3	0,4	0,31	0,09
		0,5	108,9	0,72	195,4	51,6	13,2	11,8	5,6	51,7	0,8	0,50	0,15
		1,5	125,5	0,83	224,7	53,4	16,2	12,3	5,9	54,8	1,9	0,90	0,34

supplemented with maize meal at 0,5% of body mass and groups 3, 6, 9 and 12 at 1,5% of body mass. Group 13 grazed on rye-grass pasture and then on kikuyu pasture.

The average animal gains for the different groups for winter and summer as well as the average slaughter and carcass data are presented in Table 2. Maize-meal supplementation effected significantly better animal gains on pasture. Animals on grass/clover pasture showed significantly better gains than animals on kikuyu pasture. The following regression equations for animal-response and supplementary feeding of maize meal on pasture were obtained, (y = ADG in kg, and x = average daily maize meal supplementation in kg).

(a) for groups 1, 2 and 3
$y = (65{,}42 + 18{,}98x - 1{,}549x^2)\ 0{,}00658$

(b) for groups 4, 5 and 6
$y = (61{,}06 + 31{,}27x - 4{,}120x^2)\ 0{,}00658$

(c) for groups 7, 8 and 9
$y = (86{,}14 + 25{,}22x - 2{,}65x^2)\ 0{,}00658$

(d) for groups 10, 11 and 12
$y = (73{,}68 + 38{,}89x - 5{,}89x^2)\ 0{,}00658$

Slaughter percentage and grading score were increased by increased supplementation. Animals grazed on grass/cover pasture showed higher slaughter percentages and grading scores than those grazed on kikuyu.

The width, depth and area of the eye muscle of animals wintered at an ADG of 0,65 kg were larger than was the case with animals wintered at an ADG of 0,32 kg. The depth and area of the eye muscle increased with increased levels of supplementation. Animals grazed on kikuyu pasture showed less eye-muscle depth and smaller eye-muscle area than those grazed on grass/clover. The fat covering increased with increased levels of supplementary maize meal feeding.

BEEF QUALITY

(A)VS-Pr.76/6: QUANTITATIVE AND QUALITATIVE MEAT-PRODUCTION STUDIES. INFLUENCE OF BREED, AGE AND SEX ON CERTAIN MEAT-QUALITY CHARACTERISTCS.* 1973-1975

R.T. Naudé and J.H. Dreyer

Friesland and Afrikaner bulls were slaughtered at birth, 8, 12, 16, 20 and 24 months of age, respectively. Calves were weaned at 8 months and then fed *ad lib* on a high-concentrate diet until slaughtered. Five animals of each breed were studied at each of the abov7ages. In addition to the male animals, five steers of each breed and age group were slaughtered at 12, 16, 20 and 24 months of age, respectively.

Parameters studied were the composition of a three-rib sample joint, various characteristics of the testes of the males which could illustrate sexual development, the pigment content, collagen content, collagen solubility and shear-force values of five muscles viz. the *M. longissimus thoracis, M. semitendinosus, M. semimembranosus, M. pectoralis profundus, M. biceps brachii caput lateralis*. The size and metabolic type of the muscle fibres in the *M. semitendinosus* and the *M. semimembranosus* were also studied.

Bulls of both breeds gained more rapidly than steers and were leaner than steers. At comparable ages Friesland carcases contained more fat than Afrikaner carcases, but the latter breed had a higher percentage of subcutaneous fat.

The collagen content of muscles was found to be high at birth, to decline until the age of 8 months, increase again to 12 months of age and then to remain constant up to the age of 24 months. During the period of increase in the collagen an increase in the activity of the testes was observed and was assumed to take place also in the secretion of growth hormone. The collagen content of all the muscles studied was higher for Afrikaner than Friesland cattle and as regards the muscles of the fore-quarter a higher collagen content was found in the muscles of bulls than in steers.

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*See thesis report (D.E. Cronje) on page 115)

Concomitant with the changes in the collagen content of muscles with increasing age, changes were also observed in the solubility of the collagen during ageing. A continuous decline in collagen solubility was found between birth and 16 months of age. The rate of decline was somewhat retarded between 8 and 12 months of age. This change is most probably related to an enhanced synthesis of collagen during this period of rapid growth in comparison with the growth of other muscle proteins. This meant a change in the ratio of newly-formed highly soluble collagen to existing collagen becoming less soluble. The most rapid decrease in collagen solubility took place during the period 12 to 16 months of age and was probably caused by a decline in the rate of formation of new collagen. After 16 months of age very little change was observed in the solubility of muscle collagen. The sexual activity of bulls reach a peak at 12 months of age, after which the stimulus for muscle growth and hence collagen formation declined.

The higher rate of muscle growth of bulls resulted in a higher level of collagen solubility when compared to steers.

From the results of this experiment it was concluded when comparing breeds and cattle at different ages, that shearing force or toughness was more closely related to the solubility than to the content of collagen in muscle. The decline in collagen solubility was positively related to a decline in tenderness, especially of the fore-quarter muscles of the carcass. The fact that muscles of Afrikaner cattle were more tender and contained more collagen which was also more soluble, substantiated the observation with regard to tenderness.

A gradual and sytematic increase in the pigment content of all muscles was observed with an increase in animal age. No differences between the pigment concentration of the muscles of the two breeds was observed at birth. However, the increase in concentration with age was more rapid in Afrikaner and Friesland muscles up to the age of 12 months, from when the ratio in rate of change was reversed, resulting again in no difference in the level of muscle pigment of the two breeds at 24 months of age.

The percentage of the larger, more anaerobic "white" muscle fibres increased with age and was higher in the muscle of the more rapid-growing, earlier-maturing Friesland cattle compared to Afrikaner cattle.

The appearance, eating quality and technological characteristics of meat derived from the muscles of a meat-producing animal are therefore closely related to, and affected by, the growth and development of the animal itself. The pattern and rate of growth are regulated genetically and physiologically. The influence of certain of the biological factors such as age, sex and breed of cattle were studied with regard to growth and development of muscle collagen and pigment. The hitherto incomplete picture in terms of the effect of a number of these factors on the tenderness and colour intensity of muscles, was therefore made more complete by the results of this experiment.

DISEASES-BACTERIA

OP-BACT.16: THE ANTIBODY RESPONSE OF CATTLE TO *CLOSTRIDIUM BOTULINUM* TYPES C AND D TOXOIDS. 1968-1976

B.C. Jansen, P.C. Knoetze and F. Visser

The resistance of cattle with varying serum-antitoxin titres was determined by *per os* challenge. The results proved that a solid immunity can be produced from *C. botulinum* toxins C_1 and D.

The immune response of cattle to various quantities of C. botulinum C_1 and D toxoids, aluminium-phosphate-absorbed and in water-in-oil emulsions was investigated. The response to antigen in water-in-oil emulsion was far superior to the other when they were used for primary and secondary stimuli.

Once cattle had been given a solid basic immunity with 2 injections of antigen in water-in-oil emulsion, essentially the same booster effect was obtained with antigen in water-in-oil emulsion and in aqueous solution.

A few of the animals injected intramuscularly with antigens in water-in-oil emulsion developed local lesions. These lesions were not large and their histological picture indicated a noticeable decline in severity within 20 weeks.

A case is thus made out for the use of *C. botulinum* C_1 and D toxoids in water-in-oil emulsion for the primary and secondary stimuli and an aqueous solution of these antigens for any booster stimulus as an improved method of protecting cattle against botulism.

DISEASES - PROTOZOA

OP-PROT.17 & 21: THE LIFE-CYCLE OF *BABESIA BOVIS* AND *BABESIA BIGEMINA* IN TICKS AND CATTLE IN SOUTH AFRICA. 1973-1976

F.T. Potgieter

A basic requirement for a study such as this on the life-cycles of tick-born parasites is that pure strains of the parasite concerned must be isolated and infection of known clean ticks established and maintained. This can only be done if well-managed tick-free stables and laboratory facilities for maintenance of ticks are available.

Valuable preliminary information on the life-cycle of *B. bigemina* was obtained from the transmission experiments. This was confirmed and extended by the microscopic observations. It was found that the infection was transmitted by the nymphae and adults of the one-host ticks *B. microplus* and *B. decoloratus*, and that uninfected female ticks acquired the infection from their bovine hosts during the final phase of engorgement. A notable feature of the life-cycle was the retention of the infection and its transovarian passage in the absence of reinfection from the bovine. Thus it was essential to obtain non-infected ticks in order to study the initial development in the replete female tick. Non-infected ticks were also indispensable as controls in some of the transmission experiments and for comparative purposes when studying smears under the light-microscope.

It was possible to preserve the infective forms of *B. bigemina* from *B. decoloratus* by preparing stabilates from triturated nymphae for the purpose of artificial transmission of the infection.

The intra-erythrocytic stages of *B. bigemina* were studied under electron-microscope and it was found that the merozoites closely resembled the small merozoites in the salivary glands of nymphal ticks. Merozoites, merozoites transforming to trophozoites, trophozoites and the method of reproduction were studied. True food vacuoles could not be identified and the mode of nutrition could not be determined. The multiplication process resembled one of schizogony in which 2 merozoites are produced from the mother cell. This process did not take place in a parasitiophorous vacuole.

Primary schizogony occurred in all 3 stages of *B. decoloratus* and *B. microplus* infected by transovarian passage with *B. bigemina*, and the developmental cycle of the parasite was indistinguishable in these 2 ticks. Primary schizonts and the large merozoites (= vermicules) produced by them, were observed in the gut epithelium, haemocytes, muscles and peritracheal cells. Secondary schizogony, which led to the formation of small merozoites (= infective forms), occurred mainly in the salivary glands, but was also encountered in the cortex of the synganglion. Mature small merozoites were observed in the nymphal and adult ticks only.

Both primary and secondary schizogony continued to occur in newly moulted adult ticks, resulting in transmission of the infection by adult ticks as well as infection of the ovaries of replete female ticks by large merozoites of *B. bigemina*. This explains how transovarian passage of the infection occurs, even in the absence of reinfection.

No signs of any sexual stages of *B. bigemina* were observed during the initial development of the parasites ingested by female ticks and it is not clear how the first round of schizogony is initiated in the epithelial cells of the gut. The first large merozoites produced were seen in the gut 72h after the tick had dropped. They initiated primary schizogony, a process indistinguishable from initial schizogony in the gut, by invading further gut-epithelial-cells, haemocytes and Malpighian tubes and the parasite multiplied in this way. Eventually they found their way to the ovaries where they infected the ova which led to transovarian passage of the infection. High mortality rates were caused among ovipositing ticks by severe infections of *B. bigemina*.

Only large merozoites of *B. bigemina* were detected n smears of tick eggs. Attempts to produce satisfactory sections of eggs were unsuccessful on account of the obstacles caused by the wax coating around the egg.

In the case of *B. bovis* the infection was also acquired from the infected bovine by the rapidly engorging female ticks. The infection then passed via the eggs to the next generation in which it was transmitted to cattle by the larval stage only. The larvae must have cleansed themselves of the infection as no nymphal or adult transmission could be demonstrated. Consequently the engorging female ticks had to be reinfected before they dropped from their host in order to secure transovarian passage of the infection.

Stabilates containing the infective form of the parasite were prepared from triturated *B. microplus* larvae and used as a source of *B. bovis* for infection of cattle by injection.

Microscopic examination of *B. microplus* larvae revealed that extremely rapid development of the small merozoites of *B. bovis* occurred in their salivary glands. It was also confirmed microscopically that no development of the parasites occurred in nymphae and adults, except in cases where the female ticks had engorged during a patent parasitaemia.

Merozoites, transforming merozoites and dividing forms of *B. bovis*, which produced only 2 merozoites at a time by a procss resembling schizogony, were observed in the erythrocytes of the host. The fine structure of the merozoites resembled that of the small merozoites seen in the tick. The feeding habits of the trophozoites could not be determined in this study.

Parasitized erythrocytes appeared to adhere to the capillary walls and to each other, a phenomenon observed in the capillary vessels of the brain with the aid of the electron microscope. This may explain why cattle infected with *B. bovis* eventually develop severe nervous symptoms.

Intra-erythrocytic parasites ingested by the female tick became spherical in shape and increased in size. Subsequently a club-shaped body, which was thought to initiate schizogony in the gut epithelium, developed from an unidentified predecessor. No evidence of sexual development was observed, leaving the club-shaped body unidentified. The large merozoites formed by schizogony infected other gut cells where further multiplication by schizogony subsequently occurred. Eventually they found their way to the haemolymph, where their characteristic curved "tails" were readily detectable. but they were never observed to infect any tissues other than ovaries. Large merozoites of *B. bovis* were detected in smears prepard from eggs laid by infected female ticks.

Both primary and secondary schizogony and the respective merozoites of *B. bovis* produced were studied with the aid of the electron microscope. The details of the final development in these schizonts still remain somewhat obscure but the fine structure of the mature merozoites was basically the same as that of related *Babesia* spp.

The ultrastructural features of both babesias were basically the same, apart from differences in size and a few minor aspects concerning the pellicular structure of the large merozoites. The pellicular complex of large merozoites consisted of an outer membrane underlain by a thick osmiophilic inner layer; the latter structure formed the anterior and posterior polar rings and was intimately associated with microtubules which seemed to originate at the anterior pole. Organelles in the cytoplasm included micronemes often associated with micropores which occurred in the inner layer of the pellicle, a single nucleus, a rough type of endoplasmic reticulum and mitochondria.

The fine structure of small merozoites of both *Babesia* spp. in the salivary glands of the ticks was very similar to that of the intra-erythrocytic merozoites in the bovine. The investigations revealed the presence of rhoptries and a large unidentified spherical body (the latter not demonstrated in small merozoites of *B. bigemina*), which were absent in the large merozoites. Mitochondria with and without tubular cristae were observed. Although microtubules were present in these merozoites they did not occur in fixed numbers and a constant arrangement as was the case in the large merozoites.

The close resemblance between the small merozoites and the intra-erythrocytic merozoites indicate that the former are the infective forms of the *Babesia* spp. concerned.

INTERNAL PARASITES

OP-PATH.31: STUDIES ON SCHISTOSOMIASIS. 9. PATHOLOGY OF THE BOVINE URINARY TRACT. 1973-1976

R.C. Bartsch and J.A. van Wyk

Pathological findings in the urinary tract of 40 head of cattle, experimentally or naturally infested with *Schistosoma mattheei*, are presented. Lesions of the ureter found in 57,5% of the cases consisted of linear granulomata with associated haemorrhages or granular patches. The segmental hydro-ureter caused by disruption of the muscular tunic by a granular patch type of lesion was a prominent finding.

Bilharzial bladder lesions observed in 75% of the animals were of four distinct types: granulomatous foci 1-2 mm in diameter, granular patches, polypoid patches and polyps. In all cases with bladder lesions the fundus was affected; neck and trigonal lesions tended to occur in the more severely affected bladders.

The Hoeppli phenomenon was more common than in other species and was associated with the subacute stage of lesion. Urinary bladders with ovum granulomata throughout the lamina had more severe microscopic lesions than those with ovum granulomata in the submucosa only. The stage of development of the bladder lesion was directly related to the duration of infestation of the animal. There was an inverse ratio between the percentage of live ova in the bladders and increased chronicity of the lesions.

Since the effects of reinfestation on the pathology were quantitative, a larger percentage of the reinfested animals had bladder and ureteric lesions, which tended to be more severe and, in the bladder, more chronic than in individually infested animals.

A significant rank correlation was observed between the W-D index (relating the worm burdens and the duration of infestation) and the severity of macroscopic and microscopic bladder lesions ($P<0,001$).

The duration of infestation and the W-D index were significantly greater in animals with bladder lesions than in those without ($P<0,0001$). No lesions of the bladder and ureters were found in animals infested less than 185 days, indicating an extended prepatent period in bovine urinary schistosomiasis. On the other hand, there were no significant differences between the worm burdens of animals with or without bladder lesions, suggesting that the first lesions appear between 70 and 185 days after infestation regardless of the number of worms present.

Possible migration routes to the urinary tract are discussed.

The bilharzial granulomata observed in the renal pelvis of 20% of the animals is the first reported incidence of such bilharzial lesions. The incidence of renal parenchymal lesions in infested animals was more than double that in uninfested controls.

NUTRITION

O-Gl.125/16: FEEDING VALUE OF SORGHUM HAY SUPPLEMENTED WITH VARIOUS RATIOS OF CONCENTRATES FOR MILK PRODUCTION OF HIGH AND LOW-PRODUCING FRIESLAND COWS AND FIRST-CALF HEIFERS. 1973-1976

M.H. Neitz, J.R. van Zyl, C.L. Hartman
and I.R.W. Kotze

Twelve Friesland cows and 12 Friesland first-calf heifers were divided into four production groups each, on the grounds of the milk produced during the first month of lactation (the standardisation period) and used in trials having an extra period Latin Square changeover design. Treatments consisted of the feeding of three different sorghum hay : concentrate rations in such a way that each cow and each first-calf heifer* received one of the rations for 30 days at a time.

The three sorghum hay : concentrate rations were (A) 20:80, (B) 40:60, and (C) 60:40 respectively. There were four experimental periods per animal; each animal received each of the three rations once, and the last ration a second time. A conventional digestibility trial was also run, using three lactating cows, in order to determine the different digestibility coefficients and water intake. Catheters were used to collect urine.

Dry-matter intake of ration A and B by both cows and heifers was significantly higher ($P<0,01$) than that of ration C. ME intake of ration A was higher than ration B, which in turn was higher than C. All differences were highly significant. ME intake per kg of milk produced, varied in accordance with roughage : concentrate ratio, intake being highest on the high-concentrate ration. The differences in intake between rations A and C were highly significant for both cows and heifers.

Dry-matter intake expressed as a percentage of body mass was highest for the A ration with cows and heifers, followed by the B and C rations, A and B differing significantly from C ($P<0,01$). The ration treatment produced a marked effect on body mass with cows receiving the A ration attaining a mass 23,9 per cent higher than cows on the C ration. Heifers on ration A showed a much smaller effect, gaining not much more than three per cent over ration C.

Highly significant differences were found in milk production with production on ration A being 18,0 per cent higher than that on C, for cows, and 15,5 per cent higher for heifers. The difference between milk

TABLE 1 - Composition of the Sorghum : Concentrate rations

	A	B	C
	20S:80C	40S:60C	60S:40C
	%	%	%
Sorghum hay	20,0	40,0	60,0
Yellow maize meal	62,0	41,0	22,0
Wheaten bran	62,0	4,5	2,0
Sunflower cake meal	5,0	8,0	8,0
HPC'60'	5,0	5,0	7,0
Dicalcium phosphate	1,5	1,0	0,5
Salt	0,5	0,5	0,5
Dry matter	89,57	90,55	90,76
Crude protein	13,52	12,94	13,84
Gross energy MJ/kg	17,62	17,52	17,29

*Later referred to simply as heifer(s)

TABLE 2 - Responses of the experimental animals to the treatments in terms of the different parameters

Variable	Ration treatment			
	A	B	C	Diff.
	20S:80C	40S:60C	60S:40C	
Cows				
Dry-matter intake/day (kg)	19,96	19,27	15,84	**
ME intake/day (MJ)	193,47	164,12	121,12	**
ME intake per kg milk (MJ)	9,39	8,49	6,82	**
Dry-matter intake as % of body mass	3,77	3,66	3,08	**
Milk production/day (kg)	21,39	19,96	18,13	**
FCM production/day (kg)	18,86	19,13	17,55	*
Body mass (kg)	581	545	469	**
Milk-fat production/day (kg)	0,69	0,74	0,69	NS
Milk-fat content (%)	3,22	3,70	3,79	**
SNF content (%)	8,79	8,78	8,47	**
First-calf heifers				
Dry-matter intake/day (kg)	17,42	16,87	12,89	**
ME intake/day (MJ)	168,57	143,63	98,44	**
ME intake per kg milk (MJ)	11,66	10,00	7,86	**
Dry-matter intake as % of body mass	3,82	3,71	2,87	**
Milk production/day (kg)	14,60	14,93	12,64	**
FCM production/day (kg)	13,67	13,83	12,39	**
Body mass (kg)	474	476	459	*
Milk-fat production/day (kg)	0,52	0,53	0,49	NS
Milk-fat content (%)	3,55	3,58	3,86	*
SNF content (%)	9,04	8,89	8,52	**

* $P<0,05$; ** $P<0,01$; NS non-significant ($P<0,05$)

production on rations A and B for heifers was very small indeed. FCM produced by the cows and heifers was higher on ration B than on the remaining two rations.

Milk-fat production did not present significant differences, but fat-content expressed as a percentage in milk was lowest on ration A for both the cows and heifers. Ration C produced a fat-content 17,6 per cent higher than A, for cows, and 8,9 per cent higher for heifers. Solids-not-fat content showed increases of 3,89 per cent for cows and 6,13 per cent for heifers when the roughage : concentrate ratio changed from 60:40 to 20:80. Digestibility trials indicated dry-matter digestibility to be higher on the high-concentrate ration, followed by the 40:60 and 60:40 ratios in that order. Ration A proved to be 12,82 per cent more digestible than B, and B 8,03 per cent more than C.

No significant differences with regard to water intake could be found, although the animals drank 6,5 per cent more water on ration B than on C, and 14,3 per cent more on C than on A.

Ration A proved to be the most expensive, costing 8,44c per kg, as against 7,58c for B and 6,84c for C. The cows on average realised a higher profit over feed cost than the heifers; those on ration C realised 171,9c profit over feed cost per cow per day, as against 167,7c on ration B, and 147,5c on ration A. Heifers realised 107,9c; 102,7c and 74c for rations C, B and A respectively.

The findings on dry matter and ME intake suggest that intake tended to increase with an increase in dry-matter digestibility. Conrad (1966) mentions the possibility that at digestibilities below 65 per cent (which is higher than that found in any of the rations in the present study), rumen-fill is a predominant controlling factor regulating feed intake, while above this, other factors are involved. Of course as the proportion of concentrates increases in the ration, a higher rate of digestion can be expected.

As expected, the energy requirements per unit of milk produced increased with increases in the proportion of concentrate in the ration. This increase was accompanied by an increase in total feed cost. This is in agreement with the findings of Flatt, Moe, Munson & Cooper (1969), who suggested that as the roughage content of rations fed *ad lib* decreased, the patterns of energy distribution between the productive functions of the body change, causing more energy to be used for body tissue production.

The higher body mass of the cows on the high-concentrate ration suggest that the extra ME ingested was used for the deposition of reserves in the body. Heifers do not show the same clear pattern and present a greater problem in the interpretation of the results. Rumen-fill probably partly accounts for the picture being less clear, as Moe, Flatt & Tyrell (1972) have shown that body mass does not always accurately reflect changes in body reserves.

The results prove once again that high-producing animals are more profitable from both a management and an economics point of view than low-producing animals. Since so large a portion of the feed that goes into a dairy animal is utilised for maintenance, income above feed cost will usually be maximised with high levels of milk production unless the milk-feed ratio is unusually wide. For this reason dairy animals should be fed to maximum production within the limits imposed by the inherited capacity to produce (McCullough, 1976).

Rations A and B seem more suited for high-producing (21 kg plus) cows and ration B for heifers producing 14 kg of milk and higher. At lower productions ration C should be fed. For heifers ration A does not seem to be at all suited. Dry-matter intake was high and the high unit cost of the high-concentrate ration offset the greater income from milk.

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W.Eb.93/6: A COMPARISON BETWEEN PAIL AND NIPPLE FEEDING IN THE REARING OF FRIESIAN AND JERSEY CALVES. 1970-1976

C.J.J. Brand

Eighty Friesland heifers, eighty Friesian bulls, sixty Jersey heifers and twenty Jersey bulls were distributed among four treatment groups at the age of one to six days. Two methods of milk feeding (pail vs nipple) and two levels of skimmed milk (7 vs 14 per cent of body mass) were compared with regard to their influence on growth performance and feed intake of calves.

During the first three weeks of the experiment calves received whole milk only. During the fourth week (change-over period) whole milk and skimmed milk were fed in equal proportions. Skimmed milk was then gradually increased (in relation to body mass) up to a maximum of 9,1 kg per calf per day.

In addition to milk an energy-rich grain mixture (consisting of maize, oats, oat hay, bone-meal, salt and trace elements) was freely provided from the age of approximately eight days. Water was given *ad lib* from the commencement of the trial.

In a statistical analysis of the pooled data the two methods of feeding did not differ significantly. The average mass increase of the pail and nipple-fed groups differed by only 1,6 kg in favour of the latter over a period of 16 weeks. However, a statistiscally significant difference was observed in the case of Friesland bull calves at 21 weeks of age. The nipple-fed group showed a 7,12% faster growth rate but this advantage was associated with a marked increase in feeding cost.

In an analysis of the pooled data the level of skimmed-milk feeding showed a statistically significant influence on mass gain and a highly significant influence on feeding cost (the 14% level was higher in both cases). Where data were not pooled the differences between the different treatment groups were not statistically significant but the differences in feeding cost remained highly significant. It was concluded that, althogh feeding of 14% skimmed milk will cause an increase in mass gain, this advantage will not be sufficient to compensate for the additional feeding cost.

With regard to the change-over from whole to skimmed milk, results of the present study indicated that it can be done successfully within a period of seven days. No digestive disturbances were noted.

Over a period of 16 weeks Friesian calves gained on average 21,4 kg more than Jerseys. The feed conversion of Friesians and Jerseys was respectively 1,92 and 2,18 dry matter (milk & meal) per live mass. The faster growth rate of bull calves over heifers (21,3% for pooled data) is in close agreement with that reported by other investigators.

REPRODUCTION

OK-Do.70/2: REPRODUCTIVE EFFICIENCY OF BEEF CATTLE IN THE EASTERN CAPE : INFLUENCE OF FEEDING OF LAYING-HEN MANURE ON THE REPRODUCTION OF COWS. 1972-1973

S.W. Bosman

In the coastal region of the Eastern Cape where poultry litter is readily available as a feed supplement, the incorporation of laying-hen manure in drought supplements during 1970 allegedly lead to infertility in cows. Consequently the influence of laying-hen manure as a feed supplement to beef cows during the winter was studied in comparison with a conventional urea-energy lick. Sixty Bonsmara-type beef cows were, after restrictions according to age, body mass and stage of pregnancy, randomly allocated to the following three treatments:

Treatment 1 — A conventional urea-energy lick, fed *ad lib*
Treatment 2 — Restricted (2,27 kg/beast/day) intake of laying-hen manure
Treatment 3 — Laying-hen manure, fed *ad lib*

Supplements were supplied for a trial period of 169 days during the period May to October 1972 on spared Dohne sourveld. Cows were serviced over the period November 1972 to 1 February 1973.

All the treatments showed small gains during the initial phase of the winter period. These gains favoured Treatment 3 and showed a longer above-maintenance trend on account of a higher voluntary consumption of laying-hen manure. Thereafter, body mass in all treatments declined rapidly and to such an extent that the losses between treatments became significant ($1,2 < 3$; $p < 0,01$) immediately prior to calving. Laying-hen manure proved itself further as a supplement by inducing a slower rate of loss in body mass during the more critical phase of the winter period. The overall higher loss in body mass in Treatment 1 was followed by an equally high response in compensatory growth after the change of season. This was not a noticeable feature of the treatments that received laying-hen manure.

The following calving percentages were obtained.

Treatment 1 = 52,6%
Treatment 2 = 60,0%
Treatment 3 = 68,4%

It is considered that the lower calving percentage obtained in Treatment 1 is primarily a result of the overall higher mass loss which occurred during the winter.

It is concluded that (i) the feeding of laying-hen manure, up to levels of 2,5 kg/cow/day during the winter is a substantially better supplement for the maintenance of beef cows than the conventional urea-energy lick and (ii) that the manure is no more detrimental to calving percentage than a conventional urea-energy lick under similar feeding conditions.

OP-REP.8: INVESTIGATION ON THE MECHANISM OF OVULATION IN CATTLE. 1970-1976

R.I. Coubrough

In the normal run of events progesterone levels produced by the corpus luteum plateau at about 10 days post ovulation retain this level until about day 17 of the cycle. Luteolysis then occurs and progesterone production ceases, abruptly bring about the removal of the block on the nerve cells in the brain. These cells thus become amenable to oestrogen sensitisation allowing optimal stimulation for the LH surge to occur at the time of visible oestrus. By using progesterone injections at 48 hourly intervals over a 14-day period in cycling animals, our work showed that the abrupt fall in progesterone was brought forward to day 11 of the artificial cycle. This completely upset the normal train of hormonal events and resulted in asynchrony of oestrus and ovulation, which was manifested by anovulation, delayed ovulation and silent heat. This effect was temporary, however, and subsequent cycles restored the normal pattern.

Concomitant with this progesterone drop on day 11 of treatment there was a total corticosteroid (TC) rise which was maintained over the anticipated period of heat. Animals failing to show normal cyclic behaviour have cortisol levels generally higher than normal. The circadian rhythm of corticosteroid release is now well established. In our control cows a constant fall-and-use pattern was demonstrated at the time of ovulation as against a retained high level of TC in the progesterone-treatment cows. This confirms earlier work regarding maintained high levels of TC and their association with abnormal cycles.

OP-REP.16: THE SYNCHRONIZATION OF OESTRUS IN BEEF CATTLE UNDER RANCHING CONDITIONS. 1977

H.J. Bertschinger

Two methods of oestrus synchronization were employed. The first involved the use of a synthetic oral progestagen, chlormadinon acetate (CAP). In four separate trials involving 36, 26, 29 and 47 animals respectively, each animal was treated daily with 10 mg per day for a period of 14 days. On the third day following the end of treatment each animal received 1 500 i.u. human chorionic gonadotropin (HCG) intramuscularly. The animals in Trial iv were divided into two groups, one of which (23 animals) received HCG and the other 1 mg gonadotropin releaser hormone (Gn RH), also intramuscularly. A single insemination using frozen semen was carried out 11 to 12 hours later. Pregnancy rates four months after insemination were 66,7%, 42,3%, 37,9% and 44,7% in the four trials respectively. Heifers (66,7%) showed a far better fertility compared to the cows (37,9% — 44,7%) at synchronized heat. No significant difference could be observed between the HCG group (43,5%) and the Gn RH group (45,8%) in Trial iv.

The second method employed involved the use of a synthetic prostaglandin (cloprostenol). The 90 animals available were divided into 45 test animals and 45 control animals. Each animal in the test group received a double intramuscular injection of cloprostenol (500 μg) 11 days apart. A doubl0emination was carried out at 72 and 92 hours respectively after the second cloprostenol treatment. The control group of cows was allowed to run with bulls over a three-week period. The pregnancy rate 4 months after insemination or natural service was 47% in each group.

GENERAL

BREEDING

(A)VS-Pr.38/4: PRODUCTION OF BLOOD-GROUP REAGENTS, AND IMMUNOLOGICAL STUDIES OF DOMESTIC ANIMALS, LABORATORY ANIMALS AND RELATED SPECIES: THE OCCURRENCE AND SPECIFICITY OF ANTIGENIC SUBSTANCES WITH NATURALLY OCCURRING ANTI-BODIES. 1967-1971

E.H.H. Meyer

The project was concerned with some aspects of the mode of adherence of the J antigenic substance to erythrocytes and sperm cells of cattle, and of the R substance to sperm cells of sheep. In addition the seasonal variation in the level of naturally occurring iso-antibodies in pigs was investigated. The following results were obtained:

1.1 The J substance was found to be present in the seminal plasma and serum of J and J bulls. The titre of J substance in seminal plasma was usually higher than in serum.

1.2 The sperm cells from J bulls were J positive and those from J and J bulls were J negative. Evidence was obtained that J-negative sperm cells can be coated with J substance by *in-vitro* incubation at room temperature (± 20 °C) and continuous shaking in J-positive seminal plasma or serum, and can thus be converted into J-positive cells. In some cases the results were masked by the presence of a non-specific J-like activity, which cannot be explained.

1.3 In mature sperm the J substance seems to be tightly bound to J-positive sperm cells as in nearly all cases it could not be eluted *in vitro* by continuous shaking at room temperature in J-negative seminal plasma or serum.

1.4 The J substance is apparently irremovable from J-positive erythrocytes of mature cattle by *in vitro* incubation at room temperature and continuous shaking in J-negative serum. In the case of young calves of various ages where the J substance had been acquired recently, some evidence for elution was found. A gradual ”tightening” in the binding of the J substance seems to occur.

2.1 The R substance was found in the seminal plasma and serum of R-positive rams, with the titres in seminal plasma usually two- to fourfold higher than in serum. Traces of R substance were observed in the seminal plasma of all the R-negative rams (with no R activity in the serum or on the erythrocytes).

2.2 The sperm cells of R-positive rams were found to be R-positive and those of R-negative rams to be R negative. In one out of every four cases, R-negative sperm cells could be coated with R substance by *in vitro* incubation at room temperature and continuous shaking in R-positive serum, thereby converting them into R-positive cells.

2.3 Except in one case out of 19, the R substance could not be removed from R-positive sperm cells *in vitro* by incubation at room temperature and continuous shaking in R-negative serum.

3.1 A seasonal variation was observed in the level of naturally occurring anti-A iso-antibodies in the serum of pigs, with the highest titres present from April to June (late autumn to early winter) and the lowest titres from November to January (early to mid-summer).

3.2 The results indicated that the main portion of the naturally occurring iso-antibodies in pigs are anti-A. The incidence of anti-Na was found to be very low. Interaction between the anti-Na and anti-A activity was found to occur.

3.3 The sub-population of males showed a higher level of naturally occurring iso-antibodies than the sub-population of females. The seasonale variation was also more pronounced in the sub-population of males than in the females. Even the difference in the level of naturally occurring iso-antibodies (in favour of males) showed a seasonal variation resembling the basic pattern of the seasonal anti-A activity.

Publications:

Meyer, E.H.H., 1969. Immunogenetic studies on the J, Rand A antigenic systems of cattle, sheep and pigs respectively. *Prod. Anim.* 8, 331-343.

Meyer, E.H.H., Nancy van Schaik, Osterhoff, D.R., & Geerthsen, J.M.P., 1971. Preliminary studies on the seasonal variation of naturally occurring iso-antibodies in the serum of pigs. *Proc. Cong. S.A. Genet. Soc.* 4, 55-60.

DISEASES - BACTERIA

OP-BACT.48: INHIBITION OF MACROPHAGE MIGRATION IN *SALMONELLA* IMMUNITY. 1972-1977

C.M. Cameron and J.J. van Rensburg

Protein antigens were prepared from rough strains of *Salmonella typhimurium* and *S. dublin* by phenol and veronal-buffer extraction. It was shown that the *in-vitro* migration of peritoneal exudate cells from guinea-pigs that were immunized with rough avirulent mutants could be inhibited effectively with these antigens.

The cells obtained from *S. typhimurium*-immunized guinea-pigs were also sensitive to *S. dublin* antigens and *vice versa.*

A degree of sensitivity and inhibition could be demonstrated consistently in a group of immunized guinea-pigs. However, the variation in the samples, even from among individual animals that had survived challenge, was so great that it was found to preclude the use of the macrophage-migration technique as a standard assay procedure for immunity.

(Published in *Onderstepoort J. vet. Res.* (1975))

OP-BACT.56: RELATION BETWEEN MACROPHAGE MIGRATION INHIBITION AND IMMUNITY TO *BRUCELLA ABORTUS* IN GUINEA-PIGS. 1974-1977

C.M. Cameron, J.J. van Rensburg, and
Maria M. Engelbrecht

A soluble protein antigen was prepared from *Brucella melitensis* Rev I with which macrophage migration inhibition (MMI) assays were successfully done using guinea-pig peritoneal exudate cells.

By comparing the MMI, agglutinin response and immunity of groups and of individual guinea-pigs which had been immunized with either *B. melitensis* Rev I live vaccine or *B. melitensis* Rev I inactivated antigen, an association between the MMI and resistance to infection was demonstrated.

(Published (1976) in *Onderstepoort J. vet. Res.* 43, 175-184)

MEAT QUALITY

(A)VS-Pr.76/5: HISTOLOGICAL EVALUATION OF THE ROLE OF CONNECTIVE TISSUE IN THE COMPOSITION OF MEAT AND THE DETERMINATION OF MEAT QUALITY. 1972-1976

J.H. Dreyer

This project was originally planned to determine the ratio of connective tissue to muscle tissue in certain of the larger muscles of sheep and Boer-goats. The animals were so chosen as to be representative of developed and undeveloped meat producers. A histologic survey was to have been undertaken on certain muscles of Merino, S.A. Mutton Merino, Dorper and Pedi sheep and Boer-goats.

The representative muscles were all contained in the left half of the carcass viz. the *Mi. longissimus dorsi, psoas major, semimembranosus, biceps femoris, supraspinatus* and*infraspinatus*. These muscles were carefully dissected, quick-frozen in solid CO_2 and stored in a deep-freeze chamber at minus 20 °C.

Unforeseen power failures wreaked havoc with the tissues in the muscles as slow defrosting and slow refreezing tend to form large ice crystals in the extra-cellular spaces. This has the effect of fracturing the fibre bundles and when it continues over long periods the disfiguration of the tissue is permanent and irreversible.

Various methods of processing and sectioning were applied to try and alleviate the harsh effects of the slow freezing but the samples were not fit for delicate analysis. Fortunately the material was not wasted and will be employed for supplementary samples in a sister project, A(VS) 76/2, where hydroxyproline is being determined.

INSECT PESTS

OP-ENT.22: NEUROSECRETION IN *ORNITHODOROS SAVIGNYI* (AUDOUIN)(IXODOIDEA: ARGASIDAE). THE DISTRIBUTION OF NEUROSECRETORY CELLS IN THE BRAIN. 1975-1978

Aileen A. Evans and K.R. Solomon

The arrangement of the brain and peripheral nerves in *Ornithodoros savignyi* (Audouin) is similar to that of other argasid and ixodid ticks. Histological studies, using a specialized staining technique (aldehyde fuchsin), have shown 15 groups of neurosecretory cells in the cortex of the brain.

(To be published in *Onderstepoort J. vet. Res.* (1977))

HORSES

DISEASES - PROTOZOA

OP-PROT.19: OBSERVATIONS ON THE TRANSMISSION, IMMUNOLOGY, CLINICAL SIGNS AND CHEMOTHERAPY OF DOURINE (*TRYPANOSOMA EQUIPERDUM* INFECTION) IN HORSES, WITH SPECIAL REFERENCE TO CEREBRO-SPINAL FLUID. 1973-1976

P.R. Barrowman

This paper is a record of observations on the transmission and clinical signs of dourine in naturally infected cases of known duration, and of temporal and quantitative aspects of the immune response in blood and cerebro-spinal fluid. Included in the record are observations on the presence of *Trypanosoma equiperdum* parasites in these body fluids and methods for their detection. There is evidence that the occurrence of nervous symptoms and lesions in infected horses is associated with the presence of *Trypanosoma equiperdum* parasites in cerebro-spinal fluid. The suitability of cerebro-spinal fluid as an environment for the parasite and its relationship with nervous manifestations of the disease are discussed. Observations support the previously reported lesions of peripheral polyneuritis and suggests a possible correlation between the consistent position of the nervous lesions and the drainage of cerebro-spinal fluid containing the parasite. Chemotherapy with an experimental drug, MDbE, was used with varying results in 4 horses at different stages of infection.

DISEASES - VIRUSES

OP-MOL.32: A GEL ELECTROPHORETIC STUDY OF THE PROTEIN AND NUCLEIC ACIC COMPONENTS OF AFRICAN HORSESICKNESS VIRUS. 1973-1976

Christina W. Bremer

The physico-chemical structure of African horsesickness virus (AHSV) was compared with that of some of the other members of the Reoviridae, and in particular with that of bluetongue virus (BTV), the type strain of the orbivirus genus. This study adduced evidence of a great similarity between the gel electrophoretic patterns of the polypeptides of AHSV and BTV. The molecular mass values of the 7 AHSV polypeptides range between 0,30 x 10_5 and 1,46 x 10_5 dalton, a variation similar to that of BTV. The close relation between AHSV and BTV is further affirmed by the gel-electrophoretic resolution of the AHSV double-stranded RNA genome into 10 segments.

(To be published in *Onderstepoort J. vet. Res.* (1976))

PIGS

BREEDING

(A)VS-Pr.35/3: ELECTROPHORETIC AND OTHER CHEMICAL PHYSICAL STUDIES IN FARM ANIMALS, LABORATORY ANIMALS AND RELATED SPECIES: ELECTROPHORETIC STUDIES FOR ROUTINE TESTS ON PIGS. 1967-1972

E.H.H. Meyer

Electrophoretic techniques were developed for a study of genetic protein polymorphism in the serum of pigs. The studies of polymorphic proteins and iso-enzymes included transferrins, hemopexins ceruloplasmins and amylase. Only horizontal starch gel electrophoresis was used. For transferrins the best separation was obtained with a technique based on that of Ashton and Ferguson (1963). However, for routine electrophoretic typing the method of Kristjansson (1963) with modifications by Buschmann and Schmidt (1968) was very effective, since all four proteins could be read from a single gel. For staining, the gel was sliced horizontally into four parts: The bottom part was stained for transferrin, the second lowest for ceruloplasmin and amylase, and the second from the top for hemopexin. This was a good compromise which saved on time and cost.

In the seven breeds studied, viz. Landrace, Large White, Large Black, Minnesota No. 1, Wessex Saddleback, Bantu pig and Kolbroek, the following variants were observed: For amylase the Am^B allele had by far the highest frequency in all the breeds; Am^A occurs in all breeds except Kolbroek, while the Am^{BF} and Am^C allele were present at low frequencies in certain of the breeds. The Cp^B allele of ceruloplasmin also had the highest frequency in all the breeds; the other allele, Cp^{A_1}, occurred in all breeds except the Large White. Five hemopexin alleles were found, with Hp^1, Hp^2 and Hp^3 present in all breeds and Hp^1 having the highest frequency; Hp^0 and Hp^2 occurred at low frequencies and were absent in Wessex Saddleback while Hp^1 was also absent in Minnesota No. 1. Only two transferrin alleles were encountered, with Tf at higher frequency than If , and both alleles were present in all the breeds studied.

DISEASES - VIRUS

OP-VIR.26 & 42: STRAINS OF AFRICAN SWINE FEVER VIRUS ISOLATED FROM DOMESTIC PIGS AND FROM THE TICK *ORNITHODORUS MOUBATA* IN SOUTH AFRICA. 1972-1976

A. Pini

Between 1973 and 1975, 21 outbreaks of ASF were confirmed in the endemic area of the Northern Transvaal after an interval of 10 years in which the disease was silent. The new series of outbreaks coincided with the isolation, for the first time in South Africa, of two HAd^- strains of ASF virus. The effect of these virus isolates, Lillie-148, was obtained from swine which, judging from circumstantial evidence, had been infected by a warthog carrier of virus. The pigs on the farm were affected by a form of disease with a lower pathogenicity than that observed in the previous epidemics. The second HAd^-strain

24823 was obtained from a case of which neither clinical nor pathological observations were available. From the results of the biological tests carried out at the laboratory, however, it was deduced that the disease in the field may have had a chronic course.

When the carrier status of populations of the argasid tick *Ornithodorus moubata* collected from warthog burrows was investigated, it was found that the situation in South Africa is analogous to that in East Africa. Twenty five per cent of burrows were found to be infected; the mean infective titres of the tick suspensions varied between $10^{4,5}$ and $10^{5,2}$ $BCHAd_{50}$ and the mean percentage of infected argasids varied between 1,62; and 3,45. Infected ticks were also found in the Marico district, which is adjacent to the endemic area, but ASF has never been recorded there. From tick suspension in buffy-coat cell-cultures, a HAd population of ASF virus was segregated.

From these observations it was inferred that ASF virus may mutate from the HAd$^+$ to the HAd$^-$ form in the primary virus reservoir. Furthermore, the virus appears to be evolving towards less pathogenic forms irrespective of prior adaptation of the infectious agent to domestic stock under the epidemiological conditions prevailing in South Africa.

During this investigation it was found that LLC-MK_2 cell cultures were susceptible to ASF virus. Cytopathic effects were observed in primary isolation and peak infectivity coincided with complete destruction of the cell monolayers attained after three to four serial passages. The sensitivity of LLC-MK2 cells for estimating the virus content of porcine tissues was in two instances comparable to that of buffy-coat cells, but in another three cases it was 100 to 1 000 times lower. It was concluded that LLC-MK_2 cells were a suitable complement to buffy-coat cultures for the cultivation of ASF virus, particularly for HAd isolates.

After 35 to 45 serial passages in LLC-MK_2 cells the HAd$^+$ strains of ASF virus lost their haemadsorbing characteristics. A similar mutation, but more gradual, was also observed in buffy-coat cell-cultures.

The feasibility of plaque production was studied in LLC-MK_2 cell monolayers. Plaques were obtained with all the strains studied, irrespective of their adaptation to LLC-MK_2 or buffy coat cells when 0,4% Agarose was used as a solidifying agent. The diameter of plaques ranged from 0,3 to 3,0 mm and this characteristic was unrelated to the haemadsorbing properties of the strains used. Plaque techniques were successfully used to detect the presence of HAd$^-$ virus particles in HAd$^+$ populations by subculturing selected virus-plaques into buffy-coat cultures.

The results of biological tests suggested that HAd strains have a reduced virulence which can vary within broad limits. The experience with strain Lillie-148 and 24823 showed that acute, chronic or subclinical disease can follow infection of pigs with these isolates of virus. The results obtained with the two virus populations of strain TS237 emphasized the diferent degree of pathogenicity between HAd$^+$ and HAd$^-$ virus. While the former was responsible for a peracute or acute form of disease, the latter produced chronic or subclinical infections. In pigs, mild forms of ASF also developed following the inoculation of HAd$^+$ strains obtained after serial passages in cell cultures. It was concluded that haemadsorption and pathogenicity are two characteristics that are not linked and can be modified independently.

SEROLOGICAL/STUDIES

(A)VS-Pr.36/3:

STUDY OF GENETICALLY CONTROLLED SEROLOGICAL AND BIOCHEMICAL POLYMORPHISMS IN DOMESTIC ANIMALS, LABORATORY ANIMALS AND RELATED SPECIES : THE CLASSIFICATION OF SOUTH AFRICAN PIG BREEDS — BLOOD GROUPS OF PIGS 1968-1972

E.H.H. Meyer

Seven pig breeds in South Africa were studied, viz: Landrace, Large White, Large Black, Minnesota No. 1, Wessex Saddleback, Bantu pig and Kolbroek.

They were characterized with respect to gene and phenotype frequencies of the following polymorphic serum markers:

Amylase : Am^A, Am^{BF}, Am^B, Am^C

Ceruloplasmin : Cp^A, Cp^B

Hemepexin : Hp^O, Hp^{IF}, Hp^1, Hp^2, Hp^3

Transferrin : Tf^A, Tf^B

TABLE 1 - Gene frequencies of amylase alleles in pig breeds in South Africa

Breed	Number of animals tested	Amylase allele			
		Am	Am	Am	Am
Landrace	578	0.178	0.010	0.809	0.003
Large White	131	0.023	—	0.977	—
Large Black	83	0.072	—	0.928	—
Minnesota No. 1	78	0.000	0.000	0.974	0.013
Wessex Saddleback	19	0.553	—	0.421	0.026
Bantu pig	230	0.035	0.102	0.715	0.148
Kolbroek	13	—	0.154	0.692	0.154

TABLE 2 - Gene frequencies of ceruloplasmin alleles in pig breeds in South Africa

Breed	Number of animals tested	Ceruloplasmin allele	
		Cp	Cp
Landrace	578	0.056	0.944
Large White	131	—	1.000
Large Black	83	0.042	0.958
Minnesota No. 1	78	0.051	0.949
Wessex Sad- dleback	19	0.132	0,868
Bantu pig	230	0.011	0.989
Kolbroek	13	0.269	0.731

TABLE 3 - Gene frequencies of hemopexin alleles in pig breeds in South Africa

Breed	Number of animals tested	Hemopexin allele				
		Hp^0	Hp^1	Hp^{IF}	Hp^2	Hp^3
Landrace	578	0.055	0.007	0.499	0.064	0.375
Large White	131	0.004	0.031	0.889	0.023	0.053
Large Black	83	0.012	0.012	0.735	0.066	0.175
Minnesota No. 1	78	0.045	—	0.603	0.263	0.090
Wessex Saddleback	19	—	—	0.553	0.184	0.263
Bantu pig	230	0.154	0.002	0.607	0.148	0.089
Kolbroek	13	—	—	0.500	0.038	0.462

TABLE 4 - Gene frequencies of transferrin alleles in pig breeds in South Africa

Breed	Number of animals tested	Transferrin allele	
		Tf	Tf
Landrace	578	0.003	0.997
Large White	131	0.099	0.901
Large Black	83	0.012	0.988
Minnesota No. 1	78	0.013	0.987
Wessex Saddleback	19	0.105	0.805
Bantu pig	230	0.139	0.861
Kolbroek	13	0.423	0.577

Serum samples from 1 132 pigs were analyzed by horizontal starch gel electrophoresis.

The results are summarized in the following tables in which gene frequencies of the respective protein polymorphic variants are given.

Reference:

Proc. XII Europ. Conf. Amin. Blood Groups Biochem. Polymorph. Bp. 315-322, 1972.

(A)VS-Pr.38/3: PRODUCTION OF BLOOD GROUP REAGENTS AND IMMUNOLOGICAL STUDIES IN DOMESTIC ANIMALS, LABORATORY ANIMALS AND RELATED SPECIES: THE PRODUCTION OF BLOOD-GROUP REAGENTS FOR ROUTINE TESTS ON PIGS 1967-1972

E.H.H. Meyer

Six different pig breeds were used for the production of blood-group reagents, namely Landrace, Large White, Minnesota No. 1, Wessex Sandleback and Kolbroek. The number of iso-immunization series performed were 101, consisting of 627 first-immunizations and 261 re-immunizations. An average of eight immunizations were required to build up sufficiently high titres. In the case of 51 recipients the required titres were obtained and large quantities of raw sera were bled. The fractionation of these raw sera was accomplished to various stages; the following reagents were obtained in different grades of purity:
Da, Eb, Ed, Ef, Eg, Ca, Ha, Ka, La, Ma, Mb and Mc.

SHEEP

DISEASES - BACTERIA

OP-BACT.51: EFFECTIVITY OF REV 1 VACCINE IN RAMS AGAINST *BRUCELLA OVIS* INFECTION. 1972-1976

D.V. Gradwell, F.E. van Zyl and A.P. Schutte

Vaccination with Rev 1 at four months of age protected rams against experimental infection with *Brucella ovis*. A double vaccination did not improve immunity whereas rams vaccinated later in life showed a decreased immunity to the infection. Lesions and complement fixation reactions were found to be inadequate criteria for diagnosis of the disease in the individual ram.

(Published in *Jl S. Afr. vet. Ass.* (1975))

OP-BACT.55: EFFECT OF LEVAMISOLE ON IMMUNITY TO *CORYNEBACTERIUM PSEUDOTUBERCULOSIS* IN MICE AND SHEEP. 1974-1976

C.M. Cameron

The stimulating effect of levamisole on immunity to *Corynebacterium pseudotuberculosis* in mice was marginal, while no enhancement of immunity could be detected in sheep.

The conclusion was reached that, as levamisole has no potentiating effect on immunity to *C. pseudotuberculosis* in normal sheep, it is of no practical value as an immunostimulant in this instance.

(To be published in *Onderstepoort J. vet. Res* (1977))

OP-BACT.58: METHOD OF PRODUCTION OF AND ANTIBODY RESPONSE TO AN OIL ADJUVANT *BACTEROIDES NODOSUS* BACTERIN. 1977

C.M. Cameron and W.J.P. Fuls

A procedure is described for the production of a highly concentrated *Bacteroides nodosus* bacterin.

An oil adjuvant bacterin which elicited the best antibody response in rabbits produced a response in sheep which lasted for at least 6 months.

DISEASES - FUNGI

(A)PS-Pr.35/1: STUDIES OF TOXIGENIC FUNGI OF STOCK FEEDS: LUPINOSIS IN SHEEP. 1971-1978

G.C.A. van der Westhuizen and Cecilia Roux

A field outbreak of lupinosis in sheep grazing sweet white lupins in the Western Cape Province was investigated during October 1969. Typical lupinosis was experimentally induced in sheep fed on stems, seeds and pods of plants from this field. Toxic plants were heavily infected with the pathogenic fungus, *Phomopsis leptostromiformis* (Kühn) Bubak ex Lindt. This fungus was isolated and grown in pure culture on autoclaved lupin and maize seeds. Pure cultures fed to experimental sheep induced typical clinical signs and pathological lesions of lupinosis thus proving that lupinosis of sheep is a mycotoxicosis caused by the fungus *Phomopsis leptostromiformis*.

Using pure cultures of the fungus on maize, chemists at the Veterinary Research Institute have isolated various toxic fractions. Recent experimental results on the chemical nature and structure of these toxic metabolites published by Australian workers seem to agree with the unpublished Onderstepoort results.

Because of the rapid decline in the production and popularity of lupins as a cash and pasture crop in the Western Cape Province, and the increasing interest in other leguminous crops in that area, the danger of the occurrence of lupinosis has largely disappeared. Further research on this problem is therefore considered to be unjustified.

DISEASES - VIRUS

OP-BIO.22: KINETICS OF THE IgM AND IgG IMMUNOLOGICAL RESPONSE TO SHEEP ERYTHROCYTES AND BLUETONGUE VIRUS IN MICE. 1974-1976

R.A. Oellermann, P. Carter and M.J. Marx

The IgM and IgG response in mice to sheep erythrocytes (SRBC) and bluetongue virus (BTV) was determined by means of haemolytic-plaque assays. Maximum primary IgM response occurred after 4 days but declined rapidly to 4% of the maximum by day 9. A lag period of about 2 days was observed in the appearance of IgG haemolytic plaque-forming cells (PFC) but they reached a maximum after 6-9 days. Secondary immunization resulted in the stimulation particularly of IgG PFC and from day 6 onwards IgG predominated in the immunological response.

The IgM response to BTV was remarkably similar to that observed when SRBC were used as antigen. However, IgG PFC appeared within a day of the IgM, reaching a peak on days 4 to 5. From then on, IgG PFC predominated in the response. At BTV concentrations of up to 10μg per mouse, the virulent strain of BTV type 3 produced the weakest response. At higher antigen concentrations there was very little difference in the response to the serotypes tested, although the virulent strain of BTV type 4 tended to produce the strongest response.

(To be published in: *Onderstepoort J. vet. Res* (1976))

OP-Mol 15 & 36: ISOLATION AND PRELIMINARY GENETIC CLASSIFICATION OF TEMPERATURE-SENSITIVE MUTANTS OF BLUETONGUE VIRUS. 1973-1976

S.O. Shipham and Marlene de la Rey

Temperature-sensitive mutants of bluetongue virus were isolated and classified in 6 genetic recombination groups. The frequency of recombination varied both within and between groups. The 4 mutagens used, *viz.* nitrous acid, N-methyl-N-nitroso-N-nitroguanidine, proflavine and 5-fluoro-uracil were found to differ in their efficacy. The period of incubation required for maximum recombination was 48 h at 28 °C.

(To be published in *Onderstepoort J. vet. Res* (1976))

OP-MOL.42: PROTEIN SYNTHESIS IN BLUETONGUE VIRUS INFECTED CELLS. 1977

H. Huismans

The first virus-specific protein synthesis in bluetongue virus (BTV)-infected cells can be demonstrated by immune precipitation 2-4 h after infection at 31 °C. The rate of synthesis increases rapidly 8 h after infection and then stays at about the same level until 26 h after infection. The polypeptides that are synthesized are the seven BTV capsid polypeptides as well as two noncapsid polypeptides P5a and P6a, with respective molecular masses of 54 000 and 40 000 daltons. Polypeptide P5a is synthesized in large excess of all the others but only very small amounts can be detected in the soluble protein fraction. It is the main, if not the only protein component of a complex that sediments on sucrose gradients with an S value of just less that 400S.

There is little if any evidence for specific regulation of the translation process in BTV-infected cells. With the possible exception of polypeptide P1 all the others are translated at a frequency not very different from the ratio in which the corresponding mRNA species are synthesized.

Pulse-chase experiments indicate that the BTV polypeptides do not accumulate in the soluble fraction in the same ratio in which they are synthesized. Polypeptide P3 is for instance removed from the soluble protein pool much more rapidly than any of the other capsid polypeptides. These pulse-chase experiments provided no evidence for a precursor or cleavage product relationship between any of the BTV polypeptides. The possibility that one of the non-capsid polypeptides, P6a, is a modified form of one of the capsid polypeptides can, however, not yet be excluded.

MUTTON PRODUCTION

(A)VS-Pr.73/6: POTENTIAL FOR NITROGEN RETENTION IN DIFFERENT TYPES OF SHEEP: THE INFLUENCE OF VARIATION IN THE LEVEL OF PROTEIN AND ENERGY IN THE DIET ON THE POTENTIAL FOR LAYING DOWN NITROGEN IN THE BODY OF THE S.A. MUTTON MERINO AND THE KARAKUL. 1972-1973

H.H. Meissner

In the first experiment, S.A. Mutton Merino and Karakul male and female lambs were each divided into two groups at two days of age and fed at a level of 1,2 times maintenance requirements on one of two diets. One of the groups was initially fed on cow's milk (Group C) and in the other (Group HP) a portion of the milk was replaced by a meal diet with the supplement of casein in water (Group HP) or cream in water (Group C) continuing to be bottle-fed until the end of the experiment. The ratio of DE : DCP was kept constant at 2:1 in Group HP and at 4:1 in Group C; consequently the percentage DCP in the HP ration was gradually lowered from 43% in the DM of the exclusively liquid diet to 30% in the composition of the exclusively meal diet. In the C diet, DCP was gradually lowered from 23% to 17%.

In the second experiment the same treatments applied except that the feeding level was increased to twice maintenance requirements.

Lambs were sequentially slaughtered at 3 kg intervals between 6 and 40 kg live-bodymass. The bodies were analysed for DM, N, ether-extract, ash and combustible energy.

Protein supplementation at both the high and low energy levels did not affect the protein component of body composition, presumably because the C diet already supplied enough feed protein. The fat component of body composition was influenced only at high energy level. Group C retained more fat at comparable body-masses than Group HP, whereas Group HP on the high energy level had less fat than this group had on the low energy level.

Substantial breed and sex differences in body composition and potential for laying-down of protein occurred. Karakul lambs had less protein and more fat at similar body-masses than Mutton Merino lambs and required less dietary protein to satisfy their potential. Female lambs had less protein and more fat than males at similar body-masses and required less dietary protein.

Wool growth was not influenced by protein supplementation except at the high energy level where Group HP initially had more wool than Group C. However, this difference disappeared later on in the experiment.

It was concluded that for young lambs on liquid diets, cow's milk should supply sufficient protein to satisfy their requirements. On meal diets, a crude-protein percentage of about 18 should be sufficient.

Publication:

Meissner, H.H., 1976. Die invloed van variasie in protein- en energiepeil op die proteindeponeringsvermoë van twee skaaprasse. *Agroanimalia* 8, 147-158

W-Lg.12/1:

EVALUATION OF THE PRACTICE OF EARLY WEANING WITH A VIEW TO THE INTENSIFICATION OF SHEEP FARMING IN THE SWARTLAND. 1968-1973

T.T. de Villiers

Three groups of South African Mutton Merino-type ewes were studied for three consecutive years to determine the feasibility of more breeding seasons per year (Group A) and an early weaning system (Group B), compared to the conventional sheep management system in the Swartland (Group C).

Shortcomings in the experimental design made direct comparisons difficult. Results are presented and tendencies briefly discussed.

Breeding performance data indicate that on average 89% of ewes in each group lambed during the trial. The average lambing percentages (absolute) were 136, 134 and 131 for Groups A, B and C respectively. The lamb mortalities for these groups were 32,4; 17,8 and 17,9 per cent respectively.

Group A, at a lambing interval of ± 10 months, gave 1,2 lamb crops per year or an additional crop every 5 years.

The average wool production during the trial was 4,6 kg per ewe per year and no differences in production were found.

Ewes in Group A received 9 kg more feed per ewe per year than the other two groups. Lambs from this group consumed 15% more of the early-weaning ration than those of Group B. Lambs from Group C ewes received no additional feed.

Early weaning had no detrimental effect on the growth of lambs in Group B and the average growth rates for Groups A, B and C were 0,19; 0,23 and 0,23 kg per day respectively.

No noticeable differences in slaughter mass or carcass quality were detected. Lambs from Group A obtained the highest average price per kg while Group B produced the lowest calculated mutton yield. The advantages of early weaning and more breeding seasons per year as well as higher market prices in Group A were neutralised by higher feed costs and more lamb mortalities.

The more intensive lambing system applied in this trial resulted in higher feeding costs as well as increased managerial needs, without increasing production to a marked degree. Further trials are needed before definite recommendations can be made.

NUTRITION

H-Ps.232/14:

ENSILING AND SILAGE FEEDING: ENERGY SUPPLEMENTATION TO MAIZE SILAGE FOR SLAUGHTER-LAMB PRODUCTION

P.J. Boshoff

Ram lambs from three different breeds, *viz.* Dohne Merino, SA Mutton Merino and Dormer, were used in two experiments to investigate the requirement of energy supplementation to maize silage for slaughter-lamb production. Lambs were weaned at 15 kg live mass and fed on different rations to 37 kg, when they were slaughtered. In the first experiment lambs were respectively subjected to the following treatments after weaning:

1. Maize silage *ad lib.* + 100 g fishmeal/lamb/day
2. Maize silage *ad lib.* + 100 g fishmeal + maize meal supplemented at the rate of 1% of the mean body-mass per day
3. Maize silage fed at the rate of 0,5% of the mean body-mass + maize meal *ad lib.* + 100 g fishmeal per day
4. Maize silage *ad lib.* + maize meal *ad lib.* + 100 g fishmeal per day

In the second experiment the treatments were:

1. Maize silage *ad lib.* + 100 g fishmeal + maize supplemented at the rate of 1% of mean body-mass
2. Same as (1) but maize supplemented at the rate of 2% of mean body-mass
3. Same as (1) but maize supplemented at the rate of 3% of mean body-mass

All groups had free access to a salt and dicalcium-phosphate lick.

Results of experiments 1 and 2 in terms of dry-matter intake and growth response are summarised in Table 1.

TABLE 1 - Dry-matter intake and growth rate of lambs

Group	Experiment 1					Experiment 2			
	A_1	A_2	A_3	A_4	Stat. diff.	B_1	B_2	B_3	Stat. diff.
Corrected dry-matter intake (g/day)	778	868	736	788		841	828	793	—
Growth rate (g/day)	151	214	173	173	$A_2 > A_1$*	217	199	236	—
Maize silage intake (g/day)	685	547	81	126		555	356	167	—
Maize meal intake (g/day)	—	226	611	599		210	414	547	—
Fish meal intake (g/day)	93	95	44	63		76	58	79	—
Energy intake: NEm (m Joule/day)	5,6579	6,5866	8,3599	8,1118	—	6,6766	7,8439	7,8460	—
NEp (m Joule/day)	4,1248	4,3678	5,9897	5,5036	—	4,4338	4,9909	5,1580	—
Income above feed-cost/lamb (R-c)	14,96	17,46	18,28	17,40	—	18,13	20,47	19,88	

From Table 1 it is evident that the highest dry-matter intake was achieved when maize was fed at 1% of mean body-mass (Groups A_2 & B_1). Furthermore, it appears that, in both experiments, intake increased with increasing silage levels up to the point where 65% of the total dry-matter content of the ration consisted of maize silage. Daily growth rates corresponded closely to the dry-matter intake. In expt. 1 the highest growth rate was noted in Group A_2 while in Expt. 2 the 1% maize supplementation (Group B_1) resulted in very much the same growth rate as in expt. 1 (214 g/day vs 216 g/day), although it was second to Group B_3. In the second experiment no statistical differences were recorded for growth rate. Contrary to Expt. 1, the highest overall growth rate occurred at 3 per cent maize supplementation (high-concentrate ration). *In-vitro* digestibility of all the rations was high with the lowest digestibility being for the silage + fishmeal ration.

Some of the results on carcass characteristics are summarised in Table 2. It is clear that carcass mass increased significantly with increased maize supplementation ($P < 0,05$) in expt. 1. In expt. 2 heavier carcases were produced on concentrated rations, though this result was not statistically significant. There was a tendency for most of the remaining carcass quality criteria to improve with increasing maize supplementation, particularly the scores for grading and marbling.

No statistically significant differences appeared in carcass evaluation in expt. 2. It is suggested that maize supplementation, within the range used in this experiment, will depend on the maize price. Higher supplementation will be justified in cases where the ratio of grain to vegetative parts of the plant is low and thus where silage has been made from a poor crop.

Profit margins over feed costs were satisfactory. It appears from the data that slaughter lambs can be produced profitably on rations with high maize silage content. The decision on the silage-to-grain ratio will largely depend on the prevailing prices for grain and for lamb. The grading data from expt. 1 supports the hypothesis that significant differences between treatments will occur only outside the range investigated in expt. 2. Consideration of maize supplementation will depend on the ratio of grain to the rest of the plant in the silage.

It may be concluded that maize silage can play a promising role in the finishing of early-weaned lambs for slaughter-lamb production and that the best maize supplementation will be at a rate between 1% and 2% of live body-mass.

TABLE 2 - Carcass characteristics for experiments 1 and 2

Detail		Experiment 1				Experiment 2			
Group	A_1	A_2	A_3	A_4	Stat. diff.	B_1	B_2	B_3	Stat. diff.
Shrunken carcass (kg)	16,11	17,26	17,84	18,13	3,4>1*	17,08	18,29	18,00	—
Dressing percentage	44,4	46,3	48,5	49,7	3<1*> 4>1**	46,5	49,23	49,5	—
Longissimus dorsi (cm²)	10,96	10,61	12,90	11,97	3>1,2*	11,62	12,18	13,34	—
Grade out of 10	6,0	7,43	8,0	7,67	—	6,6	8,50	8,20	—
Marbling out of 5	1,6	2,1	2,4	3,0	—	1,92	2,08	2,10	—

*P<0,05; **P<0,01

OK-DO.54/2: NUTRITIONAL STUDIES WITH MERINO-TYPE SHEEP UNDER PENNED CONDITIONS: STUDY OF THE PRODUCTIVE AND REPRODUCTIVE POTENTIAL OF SHEEP UNDER INTENSIVE FEEDING CONDITIONS. 1968-1972

H.H. Barnard

The productive and reproductive potential of three dual-purpose breeds, *viz* the Dohne Merino (DM), South African Mutton Merino (SAMM) and Corriedale (CD) were studied for three consecutive eight-month breeding cycles under semi-housed and intensive feeding conditions with 24 ewes of each breed. The breeding cycles corresponded with autumn, summer and spring lambing seasons. In order to apply intensive lamb production systems of this nature to potentially suitable areas in the Eastern Cape, the feed regimen for each cycle was planned as follows:

Cycle 1 (C1) .....An optimum plane of nutrition during all physiological phases of the ewe, with milled lucerne and maize as primary feed sources.

Cycle 2 (C2) .....Lucerne (milled) as the only feed source.

Cycle 3 (C3) .....Basically a low-quality diet consisting of maize stalks and lucerne; maize was provided at a low level (15% of diet) during lactation only. Additional crude protein was provided in the form of a high-protein lick.

Feeds were hammer-milled and fed *ad lib*. Mono-sodium-phosphate was supplied in the drinking water. Lambs were weaned at 70 days in C1 and 60 days in C2 and C3 and had free choice of suitably compounded creep-rations prior to and after each cycle. Oestrus activity was observed by means of vasectomised rams from day zero to 56 days after initiation of each cycle. All the original breeding stock were of twin-born birth.

The growth curves for the ewes which were established for individual cycles, generally reflected the level of nutrition which was supplied. C1 showed an increase of 20 to 25% in body mass from mating onwards followed by a costant mass or minor gains during lactation. A similar curve, deviating by way of a sharp fall in mass during lactation, was obtained on the lucerne-only diet. In contrast the curve in C3 fully expressed the influence of a low-quality diet.

The breeds differed in body mass throughout all cycles and in all physiological phases of production. Feed intake broadly followed suit. In all cycles crude protein exceeded NRC-standards (1968) of daily requirements. Similarly, the estimated TDN-intakes during C1 and C2 exceeded daily requirements. Noticeable exceptions were the low intake of productive energy during the lactational phase in C2, where it bordered on a deficiency, and during all the physiological phases in C3.

Lamb growth was affected by the different breeding cycles. Contrary to expectation, birth mass increased in the case of the DM and SAMM breeds and ranged from 3,1 to 4,9 kg for singles to 2,0 to 4,2 kg for twins. Daily gain from birth to weaning decreased significantly (P = 0,01) between subsequent breeding cycles and gains were 0,273, 0,245 and 0,182 kg respectively per lamb, daily. During the post-weaning period, daily gain was less markedly influenced by the feed regimen of a particular cycle, being 0,219, 0,213 and 0,227 kg per lamb for C1, C2 and C3 respectively. The net result of the differential nutritional levels was a prolonged period of 20 to 35 days in post-weaning feeding. Prior to weaning, breed differences in daily gain were not significant but the SAMM showed a significant advantage (P =

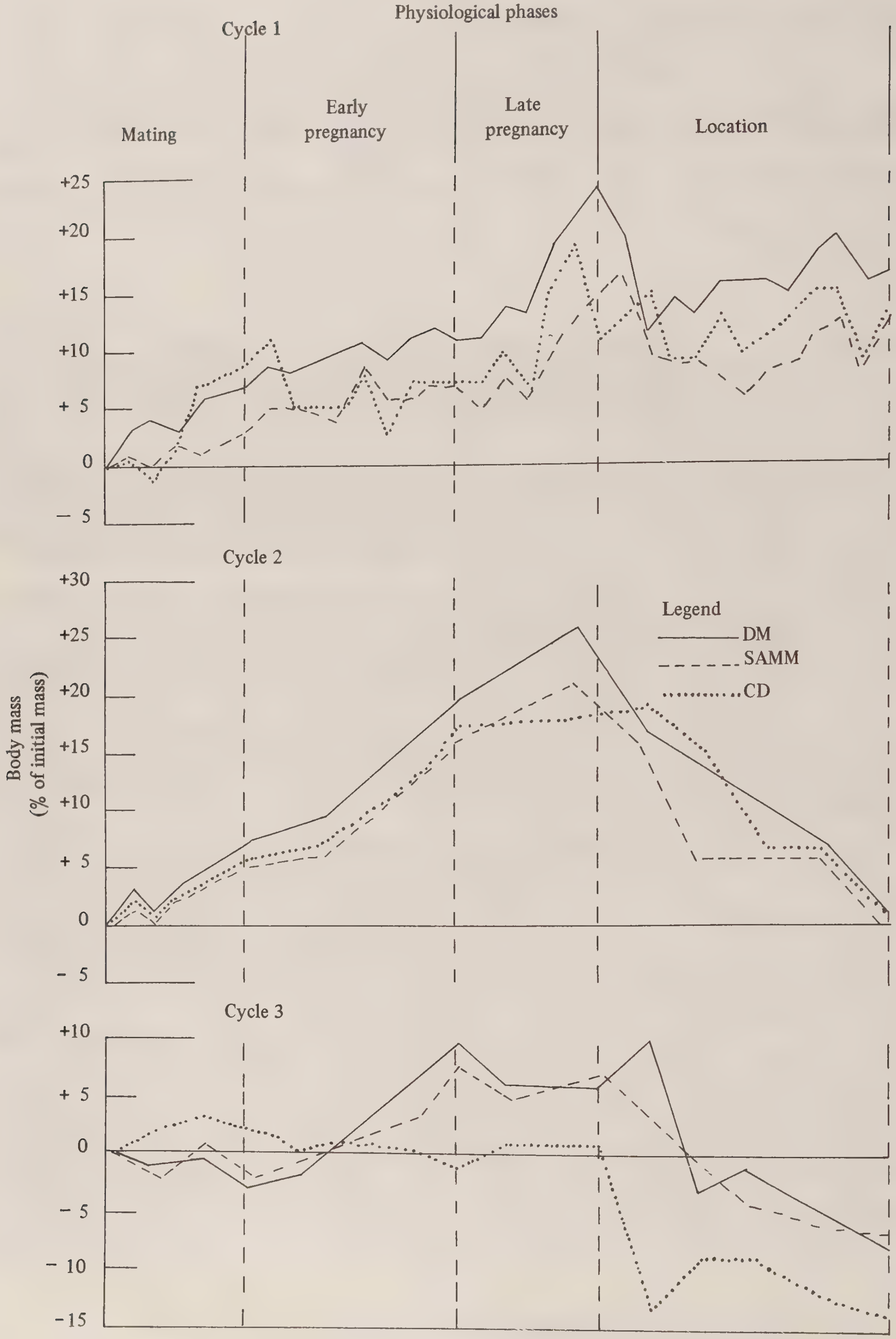

FIG. 1 - Change in mass of ewes

0,01) in growth over both other breeds during the post weaning period. Twin lambs were significantly (P = 0,01) lower in birth mass and in average daily gain prior to weaning. Stress influences lessened considerably as a result of creep-rations and singles and twins realized marketing age at 123 and 138 days respectively.

Creep-rations were incorporated successfully into the system but estimated TDN-intake prior to weaning, seldom exceeded 0,110 to 0,140 kg per lamb daily. There was a slight trend towards higher intake as a result of the stress experienced during the various lactations. Body mass increased from 19 to 35 kg in the post-weaning period and the estimated daily TDN-intake ranged from 0,64 to 0,87 kg per lamb. Differences between singles and twins, breeds and breeds x type of birth, were small and inconsistent. Feed conversion in lambs ranged from 1 : 4,4 to 1 : 7,0 and favoured the SAMM.

On account of the carry-over effect between cycles the nutritional levels exerted a less marked influence on reproduction, being largely superseded by breed differences. Approximately 85% of the ewes of the DM and SAMM breeds displayed oestrus during a particular breeding cycle. The corresponding value for CD ewes was 59%. In all breeds a further 12% of ewes displayed oestrus activity during the immediate post-mating period of 14 days. Based on the mean of three cycles, a relatively low percentage of ewes lambed, *viz* 77, 67 and 43% for the DM, SAMM and CD respectively. The seasonal breeding pattern of the CD was obvious but the values for the DM and SAMM were apparently not markedly influenced by breed or seasonal influences. It would appear that under these highly intensive conditions there may be unidentified causes for the low percentage of ewes lambing. In general the percentage of lambs born to ewes mated, ranged from 96 to 146% for both the DM and SAMM breeds and from 21 to 107% for the CD. Percentage lambs of multiple-birth constituted 44 to 72% of the lamb population in the DM and SAMM breeds and 22 to 53% within the CD breed.

All wool properties differed significantly (P = 0,01) between breeds with the exception of crimp-frequency in the DM and SAMM. Similarly all wool properties differed significantly between cycles; however, the magnitude of the response and relative superiority of a property remained unchanged. The most important economic factor, clean-wool yield, was 1,95; 2,21 and 1,21 kg per ewe for C1, C2 and C3 respectively. Fibre diameter was 25,83; 27,43 and 23,08 micron for the respective cycles. Opposing trends for crimp-frequency and staple-length occurred: The former increased significantly (P = 0,01) with a lower nutritional level (C3) whilst the latter decreased significantly (P = 0,01).

Age also influenced the wool properties. With age groups ranging from 1½ to 6½ years at one-year intervals, the breeds peaked in wool yield and staple length at the age of 3½ years. There was, however, no significant influence of age on fibre diameter or crimp frequency.

Within the present (1977) price structure of feeds in the Republic of South Africa, the total feed costs to produce lambs of 32 to 35 kg live mass were as follows:

		Cycles		
		C1	C2	C3
Ewes with singles	R c	29,55	25,95	18,39
Ewes with twins	39,66	R c	33,84	27,65
The percentage feed cost for ewes only was as follows:				
Ewes with singles	%	88	77	59
Ewes with twins	%	73	63	40

(%) = percentage of total feed cost to rear lambs to marketable age.

Positive gross margins over feed costs were realized at lamb carcass prices of 100 c/kg for twins and 120 c/kg for singles. Over the price range of 100c to 180c per kg carcass return, the mean and relative efficiency of the gross margin for singles versus twins was 100 : 357.

Wool contributed a maximum of 25% towards total income.

The economic viability of such highly intensive lamb-rearing systems depends mainly on

(i) breeds with a high fecundity,
(ii) an extended breeding season,
(iii) the correct incorporation of cheap roughage into the diet and
(iv) relatively high meat prices.

OP-DMR.35: MICROBIOLOGICAL AND CHEMICAL CHANGES IN THE RUMEN DURING STEPWISE ADAPTATION OF SHEEP TO HIGH-CONCENTRATE DIETS. 1973-1977

R.T. Mackie, F.M.C. Gilchrist, A.M. Roberts
P.E. Hannah and H.M. Schwartz

A successful stepwise adaptation was carried out on 8 sheep through diets containing 10, 24, 44, 60 and finally 71% maize meal and molasses. Ruminal biochemical parameters were related to changes in the numbers and types of ruminal bacteria and ciliate protozoa. During the adaptation, changes occurred in the morphological types of bacteria predominating in the rumen. These were not due to N-limitation since the levels of NH_3-N (> 3,6 mM) were not growth-limiting. Orderly shifts from acid-tolerant species of the lactate-utilizing and amylolytic bacteria could be correlated with a fall of about 1 unit in the prevailing ruminal pH. These shifts enabled the numbers of these key groups to be maintained at high levels despite the fall in the general ruminal pH. Sporadic appearances of *Megasphaera* or *Streptococcus bovis* are associated with the intermittent presence of appreciable amounts of lactate or glucose which promote very rapid growth.

The counts of all groups of bacteria and ciliate protozoa rose with increasing amounts of grain, but the relative increase in protozoa was greater than that in total culturable bacteria. Thus the successful adaptation up to ca. 1 day after the final diet was fed can be ascribed to the protozoa which controlled the rate of fermentation by engulfing starch grains and bacteria. With a week the protozoal numbers fell 30-80% followed by a drop in the general ruminal pH to ca. 5,4 for several hours and the numbers of total cultural bacteria rose to a peak.

Conditions in the rumen became unstable as indicated by increased peak values of ca. 0;5 mM in D and L-lactate, a decrease in acetate/propionate ratio to ca. 2, and a rise in peak glucose levels to 3,2-9,5 mM. One animal refused all food for an entire day. The acid-tolerant species of lactate-utilizing bacteria multiplied rapidly in response to the increased ruminal lactate. This controlled the rise in lactate and the fall in the prevailing ruminal pH, thus allowing the ciliate protozoa to proliferate and regain control of the fermentation. Consequently the numbers of the acid-sensitive cellulolytic bacteria/g of ingesta were of the same order after 54 days on the diet containing 71% grain and molasses ($0{,}5\text{-}13{,}3 \times 10^7$) as they were on the initial high-roughage diet ($3{,}2\text{-}76 \times 10^7$). The 3 sheep which bloated showed no marked biohemical or microbiological differences from the non-bloating animals, except that most bacterial isolates from counts on the former were characterized by slime or capsule formation.

OP-DMR.45: VOLATILE FATTY ACID METABOLISM IN SHEEP. CORRELATION BETWEEN THE VOLATILE FATTY ACID PRODUCTION AND CONCENTRATION IN THE RUMEN DURING THE COURSE OF A FEEDING CYCLE. 1975-1977

J.G. van der Walt

Four German Merino wethers were maintained on 1 600 g of lucerne hay fed twice daily. A dilute solution of a labelled volatile fatty acid (VFA) marker was infused over a period of 22h and 6 discrete rumen fluid samples were withdrawn at 2h intervals over the last 12h of infusion (08h00 — 20h00).

Total VFA production varied over the period of the feeding cycle, rising 89% from a basal rate of 3,32 moles/12h to a peak of 6,38 moles/12h at 4,5 hours after feeding. The concomitant rise in VFA concentration (39% was not as great as that of the production and the disparity was ascribed to the dilution of the VPA pool by the intake of fodder and saliva into the rumen during the period of maximum production. VFA production rate cannot, therefore, be predicted with any confidence during this period from the VFA levels present in the rumen.

Pooled rumen fluid samples were constituted from equal aliquots of the 6 discrete samples and analysed together with the above individual samples. No statistical difference ($P_6 0{,}9$) was found between the average net total VFA production rate of 4,43 moles/12h calculated from the pooled sample data and the arithmetical mean of 4,6 (range 3,32 — 6,28) moles/12h derived from the discrete sample data.

OP-DMR.47: VOLATILE FATTY ACID METABOLISM IN SHEEP. DIURNAL VARIATION IN THE CONTRIBUTION OF RUMINAL PROPRIONIC ACID PRODUCTION TO THE WHOLE BODY GLUCOSE TURNOVER OF MERINO SHEEP FED LUCERNE HAY TWICE DAILY. 1975-1977

J.G. van der Walt

Three phases of the diurnal feeding cycle, namely a pre-feeding (-2 to Oh), a maximum fermentation (2 to 4h) and a basal fermentation (8 to 10h) segment, were chosen for investigation into the contribution of ruminal propionic acid production to the whole body glucose turnover, because near steady-state conditions in the ruminal VFA pool were found to prevail during these periods. Total VFA levels of 113,5 to 102,2; 156,1 to 151,1 and 90,8 to 89,8 meg/ℓ were found for the pre-feeding, maximum and basal fermentation periods respectively. Parallel changes occurred in the propionic acid pool (18,7 to 17,2; 31,5 to 29,5 and 16,1 to 15,6 meg/ℓ). The acetic/propionic and propionic/butyric-acid-ratios revealed that propionic acid increased more than the other acids during the 2 to 4h segment.

The diurnal cycle of the total VFA production rate followed the overall concentration pattern with the exception of the maximum fermentation segment (5,67 to 6,14 moles/12h), which showed an 89 to 105% increase over basal levels (3,00 moles/12h), significantly higher than the increase of 74 to 68% in total VFA concentration. The percentage production rate of propionic acid was statisticaly indistinguishable from its molar percentage concentration except for the pre-feeding segment where the production rate (13,6 ± 0,0 molar %) at -2h.

The glucose entry rate remained relatively constant over the course of the feeding cycle (4,07 = 0,93; 4,38 = 1,03 and 3,75 ± 0,54 mg/min/kg^{0,75}for the pre-feeding, maximum and basal fermentation periods respectively) despite significant changes in glucose pool (space) and rate constant (392,5 ± 84,4 to 257,6 ± 64,6 mg/kg^{0,75} and 1,05 ± 0,21 to 1,71 ± 0,15% of pool/min. respectively.)

A constant fraction of the propionic-acid production in the rumen (28 to 45%) served as precursor for gluconeogenesis. The equation describing this straight-line relationship between the total (x) and that fraction (y) of the propionic-acid-production going to glucose was found to be $y = 0,314\ x + 0,02$ when both x and y were expressed in moles/12h.

A direct relationship between plasma insulin levels and the respective glucose fractional entry rate (% of pool/min) was found, supporting the hypothesis that insulin acts through control of the rate of peripheral uptake.

PHYSIOLOGY

OP-DMR.8: COMPARISON OF A DILUTION AND ELECTROMAGNETIC TECHNIQUE FOR MEASURING VOLUME OF BLOOD FLOW IN THE PORTAL VEIN OF SHEEP. 1968-1976

J.G. van der Walt

An attempt was made to adapt a method that had ben successfully used to measure arterial blood flow rates (e.g. renal artery) to the long-term physiological monitoring and measurement of portal blood flow rates in sheep. Once the instruments had been calibrated and the probes standardised, 3 *in vivo* acute trials were held in which 13 sheep were implanted with probes, cuffs and catheters. Only 2 sheep survived long enough to participate in the experiment. Electromagnetic blood flow (EMBF) rates for one of these sheep were estimated to be 50-60 ml/min/kg, whereas dye dilution results (using para-amino hipuric acid as marker) gave values of 75-150 ml/min/kg. The other sheep showed comparative values of 10-34 ml/min/kg for the EMBF technique and 9-38 ml/min/kg for the dye dilution method. The range previously reported in the literature by various other research workers using dye dilution methods was 10-58 ml/min/kg. Post-mortem examination of all the sheep involved showed a severe reaction of the fragile portal vein to the presence of the probe and the cuff and in one case, the establishment of a parallel patent bypass venous system. It was therefor concluded that the original goal was physiologically unattainable with the technique used.

OP-DMR.49: SEPARATION OF SOME VOLATILE FATTY ACIDS ON A "SEPHADEX" PARTITION CHROMATOGRAM. 1975-1976

J.G. van der Walt

The suitability of Sephadex LH-20 as a solid support for the partition chromatography of acetic, propionic and butyric acids was investigated by using standard mixtures of ^{14}C-labelled acids. The clear separation that was obtained between the acids was confirmed by the negligible cross-contamination found between the acid peaks. Furthermore, the Sephadex LH-20 column gave a convenient elution volume and time similar to that found for a Celite Analytical Filter Aid column, without the progressive deterioration in separation normally associated with the Celite.

REPRODUCTION PHYSIOLOGY

(A)VS-Pr.39/4: REPRODUCTIVE PHYSIOLOGY OF INDIGENOUS AND EXOTIC MALE ANIMALS IN SOUTH AFRICA: PUBERTY IN MERINO, DORPER, PERSIAN AND NAMAQUA RAMS. 1968-1975

D. Visser

Fifty Karakul ram lambs were divided into 11 age groups from birth to 300 days and slaughtered at age intervals of 30 days. Masses of the lambs, and of testes, epididimides, vesiculae seminales and hypophyses as well as seminiferous tubule diameter, number of sperm in the epididimides and fructose-content of the vesiculae seminals were used to determine the development of the reproductive tract and other sex characters. Testes mass, tubule diameter and mass and fructose-content of vesiculae seminales increased with age and mass of the lambs. At 90 and around 200 days of age, however, there were accelerated increases for testes and tubule masses which coincided with the first appearance of sperm in the epididimides at 120 days and a rapid increase in sperm numbers at 210 to 240 days of age. Results indicated that the Karakul ram is rather late-maturing, and although capable of fertilization at 120 days of age, should be used intensively only after 210 days of age.

Publications:

Rossouw, A.F. & Grobbelaar, J.A.N., 1975. Na-geboortelike groei en ontwikkeling van die geslagskanaal by die Karakoelram. *S. Afr. Tydskr. Veek.* 5, 239-242.

Skinner, J.D., 1970. Post-natal development of the male reproductive fat-tailed South African sheep, the Pedi and the Namaqua. *Proc. S. Afr. Soc. Anim. Prod.* 9, 195-196.

Skinner, J.D., 1971. Post-natal development of the reproductive tract in the Dorper ram. *Agroanimalia* 3, 7-12.

(A)VS-Pr.39/8: REPRODUCTIVE PHYSIOLOGY OF INDIGENOUS AND EXOTIC MALE ANIMALS IN SOUTH AFRICA. 1974

D. Visser

The effect of dilution, storage at 5 °C and of transport on the motility and fertilizing capacity of Gotlander semen.

Semen was collected by means of artificial vagina from four mature Gotlander rams, and evaluated. Ejaculates with good motility were pooled before dilution (1:3) at 30 °C with either Tris (250 mM)-fructose (55,5 mM) or skimmed milk. Egg yolk was included at either 5% or 10% (v/v) concentration and the diluted semen was examined at 30 °C and then every 24 hours for 72 hours during storage at 5 °C. The spermatozoa survived better in Tris than in milk, and also with 10% rather than 5% of egg yolk. Combination of Tris with 10% yolk gave best results and semen from three rams was diluted with this medium, cooled and transported by air from Irene to South West Africa. All samples showed good motility on arrival, but the viability declined very sharply after 48 hours. Karakul ewes were inseminated twice during standing oestrus after synchronisation with vaginal sponges and 300 I.U.P.M.S., but no 0001fertility resulted.

O-Ut.32/12: SYNCHRONIZATION OF OESTRUS IN LACTATING KARAKUL EWES DURING THE BREEDING SEASON AND ANOESTRUS. 1975-1977

D.A. Boshoff, A.S. Faure, F.J.L. Burger
and G.J. Minnaar

Lactating Karakul ewes were divided into three groups of forty each. Intravaginal sponges were inserted 28, 38 and 48 days post partum for a period of 15 days in these groups. At sponge insertion half the lambs in each group were weaned to form lactating and non-lactating groups. At sponge removal each of these six sub-groups was again divided into two equal groups. At this stage 500 or 300 I.U. PMSG were administered subcutaneously to each sub-group. After sponge withdrawal the duration of the induced oestrus, the interval between sponge withdrawal and the commencement of oestrus, the time of ovulation and the number of ovulations in each group were determined. The experiment was carried out during the breeding season and during anoestrus.

Oestrous duration was significantly ($P<0,01$) shorter in the 28 days post partum as well as in the lactating groups. The mean interval between sponge withdrawal and the commencement of oestrus during anoestrus was significantly ($P<0,05$) shorter in the higher PMSG groups.

This interval was significantly ($P<0,01$) shorter in the earlier post-partum groups during the breeding season. However, it was not consistently affected by the different post-partum periods during anoestrus or by lactation. The time ovulation was not influenced if determined in hours from the commencement of oestrus.

The occurrence of ovulation in hours after sponge removal, however, followed the same tendency as the interval between sponge withdrawal and the commencement of oestrus. The treatments had not effect on fecundity.

Publication:

Boshoff, D.A. & Faure, A.S. 1976. Time of ovulation in lactating Karakul ewes following synchronization of oestrus during the breeding season. *S. Afr. J. Anim. Sci.* 6, 187-190

SMALL STOCK

NUTRITION

OP-DMR.12: GLUCONEOGENESIS FROM AMINO ACIDS IN THE OVINE LIVER *IN VIVO* 1. THE CONTRIBUTION OF ASPARTATE AND GLUTAMATE. 1968-1976

J. Procos

At the time this project was registered only 10 amino acids were considered capable of contributing to the glucose pool of sheep. Of these, only 5, namely alanine, serine, threonine, aspartate and glutamate had been proven to be truly glucogenic.

In view of the lack of information concerning the general metabolism of the amino acids in mammalian tissues, an extensive survey of the literature was undertaken in order to ascertain the various types of reaction via which the amino acids are capable of being catabolised. It became increasingly clear that, despite previous claims to the contrary, all the amino acids except leucine were to a greater or lesser degree capable of forming glucose in various mammalian organs.

The problem became further complicated when it was realised that amino acids can be catabolised via widely differing metabolic pathways depending on the organ in which their degradation occurs. For example, glutamate gives rise to α-ketoglutarate in the liver with the aid of the widely distributed glutamate dehydrogenase. The brain on the other hand possesses a totally different enzyme (glutamate decarboxylase) which catalyses the conversion of glutamate to L-aminobutyric acid. Another amino acid, namely tyrosine, gives rise to epinephrine in the adrenals, while in the liver the same amino acid is converted to acetoacetic acid by an entirely different series of reactions.

Since the liver is accepted as the major site of glucose formation it was obvious that in order to determine the gluconeogenic capacity of each amino acid it would have to be infused into the blood stream via a catheter inserted into the portal vein. Simultaneously with the catheterization of the portal vein the vena cava was ligated in order to stop the inflow of endogenous amino acids into the liver.

The technique led to many complications, the most serious being that the catheters tended to block just as the animals appeared to have recovered from the operation. In addition, occlusion of the vena cava often led to the induction of collateral circulation thus nullifying the efficacy of the whole operation.

Another important technical difficulty was the lack of specific methods for determining individual amino acids. Only the enzymatic methods for determining aspartate and glutamate were available at the time. Although both methods were tried and found to be both accurate and sensitive they were rather cumbersome and definitely unsuitable for routine work. The only other alternative was to use an amino-acid analyzer which at best could produce two complete analyses per 24 hours.

The final problem was concerned with the actual metabolism of the amino acids. From the survey it became clear that the activity of most enzymes concerned with the catabolism of amino acids is definitely enhanced by cortisol while gluconeogenesis in general is facilitated by a drop in insulin levels. Obviously the hormonal status of the animal has to be taken into consideration prior to ascertaining the contribution of each amino acid to the glucose pool.

In view of all these difficulties only the exploratory work as summarized here was done in this project. No further work is visualized.

Farm Birds

FOWLS

DISEASES

OP-POUL.9: THE SENSITIVITY TO ANTIMICROBIALS OF *E. COLI* ISOLATED FROM 161 OUTBREAKS OF COLISEPTICAEMIA IN BROILERS IN SOUTH AFRICA

S.B. Buys, L. Coetzee and P. van der Walt

The standardization of a method to perform antibiograms is decribed. Meuller Hinton agar was routinely used and it was found that from 1973-1975 the resistance of *E. coli* to oxytetracycline and sulphonamides decreased and the resistance to furazolidone increased. There was no dramatic change in the resistance to neomycin and chloramphenicol.

DISEASES - VIRUSES

OP-POUL.18: EVALUATION OF IMMUNITY AGAINST NEWCASTLE DISEASE (NCD) BY MEANS OF THE HAEAGGLUTINATION INHIBITION (HI) TESTON EGG-YOLK SAMPLES. 1973-76

L. Coetzee

In this study adult, susceptible white Leghorn laying hens were each given a primary dose of 10^4 ELD_{50} Komarov NCD vaccine virus intramuscularly. A booster dose of Komarov vaccine was given 19 weeks later. Nine weeks after the seond injection half of the remaining fowls were given a third injection of this vaccine and the other half a booster injection of inactivated oil-emulsion vaccine intramuscularly. The primary, secondary and tertiary immune response of the fowls were monitored by weekly HI tests on egg-yolk samples and confirmed by intratracheal challenge of a few randomly selected hens with virulent NCD virus every 14 days.

In the primary immune respone HI antibodies reached a peak of more than log $2^{10,5}$ during the 3rd week and complete immunity, based on absence of symptoms following challenge, persisted for more than 15 weeks. At the end of the 17th week only nervous symptoms developed in 20% of challenged fowls. The HI antibody response to the second injection of 10^4 ELD_{50} of Komarov virus was disappointingly low and after reaching a peak of log $2^{7,6}$ during the 5th week it dropped to zero by the 9th week. The serological response in the group which received the 3rd injection of Komarov vaccine reached a peak of log 2^{10} during the 5th week and was maintained at a satisfactory high level (more then log 2^7) for 20 weeks.

The HI antibody response in the group which received the oil-emulsion vaccine was significantly better. A peak of log 2^{11} was reached during the 3rd to 4th week and a satisfactory high level was maintained for 29 weeks. However, no mortality occurred in hens of both groups challenged 13 months after the last injection although HI tests were negative for a period of 6 months.

The results showed that the HI test on yolk samples can be successfully employed to monitor the immune response in laying hens to various NCD vaccination schedules and it appears as though log $2^6$is the lower limit of HI antibodies reflecting protection against a fall in egg production following challenge with virulent virus. The results also demonstrated that although a sustained immunity was obtained by booster inoculations of both Komarov (10^4 ELD_{50} per dose) or oil-based inactivated vaccine, the HI antibody response evoked by the latter was maintained at a higher level for a longer period.

NUTRITION

OP-POUL.21: HEAT-STRESS MORTALITY IN NICARBAZINE FED CHICKENS. 1977
S.B. Buys and R.W. Rasmussen

Significantly higher mortalities were found in chickens fed food supplemented with 125 p.p.m. nicarbazine compared to chickens fed food supplemented with 125 p.p.m. amprolium plus 8 p.p.m. ethopabate when exposed to the same heat-stress conditions.

Game

REEDBUCK

INSECT PESTS

OP-ENT.30: *IXODES (AFRIXODES) NEITZI*, N. SP. (ACARINA: IXODIDAE) FROM THE MOUNTAIN REEDBUCK IN SOUTH AFRICA. 1975-1977
C.M. Clifford, Jane B. Walker and J.E. Keirans

Ixodes (Afrixodes) neitzi n. sp. is described from female and males collected from the mountain reedbuck (*Redunca fulcorufula*) at Loskop Dam Nature Reserve, Transvaal. Information is provided to distinguish this new species from other closely related *Ixodes* species that occur in the Ethiopian region.

Its predilection sites are noted and the area in which it occurs is described briefly.

CHEETAH

REPRODUCTION

OP-REP.5 & 6: SOME ASPECTS OF NORMAL AND ABNORMAL SPERMATOZOA IN CHEETAH (*ACINONYX JUBATUS*). 1970-1976
R.I. Coubrough, H.J. Bertschinger, J.T. Soley and D.G.A. Meltzer

This paper outlines some ultra-structural characteristics of normal cheetah spermatozoa as well as some major defects encountered in semen samples collected from a group of male cheetah examined for fertility.

The head of cheetah spermatozoa in planar view has a compressed elliptical outline while in sagital section the head is pear-shaped being considerably broader at the basal plate. The head is thus more globular than that encountered in most other mammals. The mitochondrial sheath has a pars spiralis as well as a pars ascendens which almost extends up to the redundant nuclear membrane folds. Capitellum and connecting piece are similar to those seen in other species. No distinct annulus has been found and the fibrous sheath of the principal piece is far more delicate than that encountered in other species. It has an open grill appearance similar to that present in dog spermatozoa.

Although head plenomorphism was often present the most commonly seen abnormalities involved the tail. Either the whole tail, or only the principal piece, showed varying degrees of bending from a simple loop through the retained cytoplasmic droplet to a tightly coiled tail again associated with cytoplasmic remnants. Many spermatozoa with this defect also had mitochondrial malformation. Axial filament elements were frequently missing especially in the principal piece. This defect was similar to the derangement observed by Blom and Birch-Andersen in the Dag defect in bulls. The incidence of these major defects was associated with a markedly lowered fertility in otherwise virile males.

Botany

ECOLOGICAL BOTANY

SURVEY

OK-Do.79/1-5: BOTANICAL SURVEY OF THE UPPER ORANGE RIVER CATCHMENT AREA. 1974-1977

L. Viljoen

The vegetation of the Melkspruit, Waschbankspruit, Saalboomspruit, Sterkspruit and Oslaagte subcatchment areas was classified, described and mapped on the basis of data assembled by means of veld reconnaissance, observations, botanical surveys and aerial photographs.

PLANT PROTECTION

DISEASES

FUNGI

(A)Ps-Pr.17/3: FUNGUS FLORA OF *CENCHRUS CILIARIS* L.
1975-1977
H. Bezuidenhout

Cenchrus ciliaris is a common and important pasture grass species in South Africa. However, little information is available on its the pathogenic fungi and none on the saprophytic and possible toxigenic fungi associated with this grass and its litter.

For the purpose of this survey, leaf samples were collected every two weeks over a period of one year at the Roodeplaat Research Station near Pretoria.

A total of 139 taxonomic entities were found on leaves and leaf debris on two plots of *Cenchrus ciliaris*. These included *Phycomycetes, Ascomycetes, Basidiomycetes* and *Deuteromycetes*.

The Hyphomycete genera of which 66 were found were studied in greater detail. The numbers of species representing these genera differed appreciably but some genera such as *Curvularia, Drechslera, Fusarium* and *Periconia* were each represented by 10 or more species. A total of 60 species new to South Africa was recorded in this study.

Although various pathogenic species were recorded on the plants, no lesions or symptoms of disease were observed during the survey.

The frequency of occurrence of the different genera varied thoughout the year. Variations in the numbers of some species were seasonal but in others these were due to factors such as temperature, rainfall, frost, application of fertilizer, irrigation and grazing.

(A)PS-Pr.40: DOWNY MILDEW FUNGI OF MAIZE AND SORGHUM IN SOUTH AFRICA. 1971-1975
G.C.A. van der Westhuizen

A survey of downy mildew fungi (*Sclerospora* spp) in South Africa, showed that *Sclerospora sorghi* infects both maize and sorghum. *Sclerospora graminicola* occurs on *Pennisetum typhoides* and *Setaria* spp. but not on maize and sorghum. No evidence of the occurrence of *Sclerospora philippinensis* was found.

Sclerospora sorghi attacks maize and sorghums mainly on the Springbok Flats in the central Transvaal where heavy clay soils, high temperatures and erratic rainfall favour infection from oöspores. Infection may be severe in individual fields but the disease is of little economic importance.

Publication:

Van der Westhuizen, G.C.A., 1977. Downy mildew fungi of maize and sorghum in South Africa. *Phytophylactica*, 9, 83-89.

(A)PS-Pr.41/3: SEED-BORNE FUNGAL PATHOGENS AND DISEASES OF JAPANESE RADISH AND THEIR CONTROL IN SOUTH AFRICA. 1975-1977
M.A. Holtzhausen

During 1974 severe yield losses were caused by a leaf-spot disease in a field of Japanese radish in the Transvaal Highveld. This initiated a survey of the diseases of Japanese radish in South Africa. Those recorded were *Alternaria* leaf-spot and wirestem, anthracnose, black rot, soft rot and white blister. A survey was also made of pathogens occurring in locally produced seeds.

Seeds of 18 samples were plated out on water agar containing 2,4-dichlorophenoxyacetic acid. Readings were made after 10 days at 20 °C. The most common seed-borne pathogen was *Alternaria raphani*. Other pathogens recorded were *A. brassicae, A. brassicicola, A. cheiranthi, Phoma lingam,* The clearly visible external changes in and symptoms of larvae infected with both viruses were described. It was found that the incubation period of the NPV is 3 days and the LT_{50} 6 to 7 days in third instar larvae. The corresponding periods for the GV are 4 and 22 days respectively. GV-infected larvae were also found to live up to about 20 days longer than uninfected larvae before dying of the virus. This increase in larval life-span was found to be accompanied by an increased growth and feeding rate.

Bio-assays with the viruses on larvae of increasing ages proved that all the instars are susceptible to both viruses. It was also found that true resistance to viral infection does not develop with an increase in larval age, although a certain measure of what is termed ”dilution effects” does appear. It was also found that if NPV infection takes place late enough, pupation can prevent the death of the host insect, while this phenomenon does not occur in the case of GV infections.

Dosage-mortality studies revealed the extreme virulence of the two viruses. A dosage of 840 POB/ml caused 18,8% mortality in third-instar larvae, while 13 ng/ml of the GV suspension resulted in 12% mortality in larvae of the same age. It was also found that the rate of mortality varies directly with the concentration of the inoculum in the case of NPV. However, massive doses of either of the viruses did not increase their effectiveness as pesticides.

The influence of high and low temperatures on both the hosts and viruses was studied. Temperature *per se* was found to exert little influence on the susceptibility of the host. If the host is subjected to a short period of low temperatures (e.g. the occurrence of frost in the field) shortly before infection, the effect of the virus is increased, while if the decrease in temperature occurs after infection, the effect of an equal virus dose is increased. Both viruses were also found to have a high degree of thermostability.

The ability of a number of stimuli to activate latent infections was investigated and it was concluded that none of the stimuli are successful stressors.

It was found that host resistance to larval infection will not develop as easily as with the use of chemical insecticides. This was demonstrated by the fact that no indication of resistance could be found after 22 generations of the host had been continuously subjected to the virus.

Although *H. armigera* is immune to the NPV of *Colias electo*, Dionocopus amasis and *Plusia*-spp. and to the GV of *Phthorimaea opperculella*, the NPV of *H. armigera* is as infective for *D. amasis* as it is for its primary host.

It was shown that *H. armigera* is very susceptible to both the NPV and GV, but these viruses seem to exert an interfering influence on each other because the mortality induced by a simultaneous infection of both viruses is lower than that induced by each virus separately.

It was found that, although the adults are immune to both viruses, trans-stadial transmission to the F_1 larval progeny takes place. Both transovarial and transovum transmission mechanisms are involved in the transmision process. It was further proved that the fairly common occurrence of adults emerging with malformed wings is not due to a virus infection. It is suggested that the malformation is due to certain adverse environmental conditions experienced either by the larva or the emerging adult.

The ability of both viruses to withstand chemical disruption by a number of organic solvents was demonstrated. The only substance included in the tests which successfully disrupted the virus is sodium hypochlorite and this chemical is therefore one of the few that can be recommended for sterilizing glassware and other laboratory equipment.

Two trials were conducted to determine the effectiveness of the viruses under field conditions. In the first one conducted on the Outeniqua Experiment Farm (near George) only the NPV was used. Although the experimental outlay was seriously lacking in certain respects, the results were nevertheless encouraging. The second trial, carried out near Delmas (Transvaal) included both the NPV and GV, and the results indicated that both viruses can be successfully employed as microbial pesticides, although more attention should be given to the formulation of the sprays.

GV-infected larvae were found to have different feeding habits and localized migration patterns on plants. Instead of seeking shelter on the plant in the normal way, infected larvae tend to become very sluggish, remain on exposed parts of the plant, and in some cases lose the ability to cling to the plant. These factors probably contribute to the fact that GV-infected larvae are seldom found in the field.

From the results of this project it can be concluded that while there are still some problems regarding adequate protection against UV irradiation, there is no reason why insect viruses cannot be developed as very effective microbial pesticides in South Africa as has been the case in a number of other countries.

In addition to the work done on *Heliothis* viruses, a GV was isolated from *Cryptophlebia leucotreta* which came from a laboratory culture in Nelspruit. It was the first time a granulosis had been isolated from this insect. The virus capsules measured approximately 4,68 x 0,5 μ. Associated with the GV, long rods with a diameter of between 14,9 and 23,35 nm were also found. According to the literature these organisms have only been found once before and are the causitive agents of ”molecular disease”, an

Rhizoctonia sp. and *Sclerotinia* sp. Certain samples were heavily infected. Sixteen different seed treatments were also evaluated for the control of pathogenic *Alternaria* spp. and *Phoma lingam*. Three different seed treatments were used, *viz* hot water, fungicidal soak and dry fungicide treatments and also different fungicides (benomyl, captab, copper oxychloride, fentin acetate/maneb, mancozeb, maneb, phenylmercury acetate, quintozene and thiram). Hot-water treatment at 50 °C for 25 min. and soaking of seeds in 0,2% suspensions of both captab and thiram at 30 °C for 24 h, effectively eliminated both pathogenic *Alternaria* spp. and *Phoma lingam* from Japanese radish seeds without lowering the seed germination.

Because of the prevalence of seed-borne pathogens on locally produced Japanese radish seeds, both seed producers and farmers are advised to treat their seed as a routine measure.

O-Gl.136/2: SAPROPHITIC SURVIVAL OF *RIZOCTONIA SOLANI* (KUHN). 1975-1976

G.J. de Swardt

The effects of (a) mature plant amendments (cotton, oats, wheat, maize, lucerne and soybean), (b) rock-lobster shells, (c) different carbon sources (sucrose, glucose and molasses) and (d) different nitrogen sources (urea, ammonium nitrate and ammonium sulphate) on the survival (saprophytic and parasitic activity) of *Rhizoctonia solani* were assessed under greenhouse conditions. Saprophytic activity of the fungus was assayed by the cotton stem-segment-colonisation method. Saprophytic activity was expressed as a percentage of segments colonized by the pathogen. Parasitic activity was determined on cotton seedlings — the number of plants emerging and surviving after 21 days were counted.

The dry-plant amendments were ground and incorporated separately into the soil at the rate of 1% m/m. All the amendments reduced the saprophytic as well as the parasitic activity of *R. solani*. Maize amendments were responsible for the greatest reduction in saprophytic and parasitic activity while soybean amendments were the least effective in suppressing the activity of the fungus. In general the effectivity of the amendments increased with time. The influence of maize, oats and cotton amendments lasted longer than that of lucerne and wheat.

Carbon from both sucrose and glucose added to the soil at the rate of 1 and 2% caused a considerable reduction in the saprophytic activity of the fungus. The effect of molasses showed great variation. The number of plants surviving in soil amended with sucrose and glucose at 1% was significantly higher than that in the control throughout the experiment. In spite of the very low saprophytic activity of *R. solani* at the 2% level of sucrose and glucose, a very low percentage of plants emerged and survived after 21 days. High concentrations of carbon dioxide, toxic amounts of available Al^{+++}, Fe^{+++} and Mn^{++} caused by the low soil pH, as well as fungi other than *R. solani* could have contributed to this phenomenon.

Urea drastically reduced the saprophytic activity of the fungus while ammonium sulphate and ammonium nitrate had a slight stimulating effect.

Rock-lobster shells at the rate of 1 and 2% caused a considerable suppression of the saprophytic as well as the parasitic activity of *R. solani*. Although lobster shells contain only 12-20% chitin they were just as effective as pure chitin in suppressing the saprophytic activity of *R. solani*. Chitin and lobster shells at rates lower than 1% did not suppress the saprophytic activity of *R. solani* effectively.

GENERAL

BIOLOGICAL CONTROL

(A)I-Pr.116: INSECT CONTROL BY VIRUSES. 1972-1977

V.H. Whitlock

The two viruses of *Heliothis armigera* (Hübn.) which were studied in this project, were the nuclear Polyhedrosis virus (NPV) and the granulosis virus (GV). A successful method of separating these two viruses in suspension was developed. The method is based on the gravimetrical sedimentation of the viruses in a sugar density gradient under normal atmospheric conditions. The concentrations of the resulting pure suspensions are determined by polyhedral counts with the aid of a haemocytometer in the case of the NPV, and by means of dry mass measurements for the GV.

An improved semi-artificial rearing medium for *H. armigera* was also developed during the course of the project.

apparently fatal condition. Although the nucleic acid content of these rods was similar to that of the GV, no serilogical relationship between the two could be established.

Samples of the Karoo caterpillar, *Loxostege frustalis* were received from the Grootfontein College of Agriculture, and while no virus was found, a certain number of fungi (some of which are known to be pathogenic to insects) were isolated. Since this work fell outside the scope of this project, it was referred to the mycology section.

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MOTHS

CONTROL

(S)WP.32: BIOLOGY AND CONTROL OF THE CODLING MOTH, *LASPEYRESIA POMONELLA* (L.) 1953-1977

A.C. Myburgh

Codling moth, *Laspeyresia pomonella* (L.), is the most important pest in South Africa of apples and pears, and to a lesser extent of apricots, peaches and plums. On apples and pears three generations have been found to live out their life-cycle in a single year. A few of the first-generation mature larvae, a large proportion of the second and all of the third were found to overwinter in a diapausing state in cocoons. It was shown that three major flights of adult moths, corresponding with the successive generations, occur from September to April, with the highest peak usually at about full-bloom.

The overall sex ratio was 0,9 females to 1,0 males. The ratio varied from 1,3 : 1,0 during the post-blossom phase of the first brood to 0,7 : 1,0 during the third brood. The probable under-estimation of female numbers on the basis of sex-trap catches of males, should be taken into account during the first period. The probable over-estimation of third-brood female activity could encourage the expectation of a greater infestation potential close to harvest and consequently a not undesirable increase in precautionary measures.

Initial experiments on a relatively small scale, followed by large-scale experiments in 800 hectares of apples and pears, proved that sex-trap monitoring systems can be a successful adjunct to codling-moth control programmes. A monitoring range of two hectares was found to be most practical, although the range was considerably larger under very low infestation potential conditions and *vice versa*. It was found possible to omit sprays altogether for a whole season under potential low-infestation conditions represented by a total seasonal catch of less than 20 moths per two-hectare monitoring area.

However, codling-moth resurgence invariably occurred to a highly significant degree in all experimental orchards during the ensuing season, showing the necessity for at least a basic maintenance programme of three to four spray applications to contain the pest at an acceptably low level. Programmes of up to eight sprays were necessary under high infestation potential conditions which were clearly indicated by the monitoring systems.

Experiments on chemical control of codling moth necessarily constituted an important facet of this project which was initiated soon after the commencement of the synthetic organic insecticide era. DDT proved to be very effective, but alternatives had to be found when the pest became resistant to DDT after 10 years. This led to the development of *inter alia* azinphos-methyl, which is still one of the most effective pesticides against codling moth. In addition, a range of more versatile pesticides, such as methidathion and fenthion, was developed in order to control other pests concurrently with codling moth.

The present pesticides and control programmes, supported by monitoring systems, are highly effective if properly managed. Further improvements in codling-moth control could arise from greater efficiency of spray application, synchronisation lwith the control of other pests and the development of entirely new types of pesticides such as growth retardants and chemosterilants.

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UNDESIRABLE PLANTS

NASELLA

OK-Do.68/6:

CONTROL OF UNDESIRABLE PLANT SPECIES IN NATURAL VEGETATION: SPRAYING AND OVER-SEEDING OF NASELLA *STIPA TRICHOTOMA*.

1975-1977

L.O. Nel and J.H. I'Ons

An experiment was conducted on a dense stand of Nassella, *Stipa trichotoma* (formerly *Nassella trichotoma*) in a high-lying part of the Dohne Sourveld to compare the effects of applying glyphosate (Roundup) with a standard application of propop (Dowpon). The treatments were applied in February and December 1975.

After spraying, the plots were oversown with *Eragrostis curvula*, cv. Ermelo and *Dactylis glomerata* cv. Danish and fertilized with 26 kg P/ha and 240 kg N/ha annually.

Details of the treatments and their efficacy as determined by visual rating eight months after herbicide application, are given in Table 1.

Propop was the best treatment when applied in February while the soil was dry. Glyphosate, at 8 litres/ha, produced the best results when applied in December while the soil was moist. Plant counts revealed that the percentage kill varied between 80 and 96%. The remaining plants could have been fairly easily removed by spot-spraying or hoeing.

TABLE 1 - Treatments and effects

Herbicide	a.i.*	Quantity per ha	Time of application	Efficacy rating
glyphosate	41%	4 litres	February	satisfactory
glyphosate	41	8 litres	February	satisfactory
propop	85	40 kg	February	very good
glyphosate	41	4 litres	December	satisfactory
glyphosate	41	8 litres	December	very good
propop	85	40 kg	December	good

*a.i. = active ingredient

The plots sprayed in February were accidentally burnt during October of the same year. After the burn there was a vigorous regeneration of Nassella from seed. Nasella regeneration took place on a far smaller scale in the unburnt plots.

The first attempt at oversowing in the February sprayed plots failed due, at least partly, to poor rainfall, but a second attempt a year later was successful, as was oversowing after the December treatment. The oversown Eragrostis did not survive the winter but the cocksfoot (*D. glomerata*) persisted well. There was a slight tendency towards better establishment on the glyphosate plots than on the propop plots.

In the burnt section of the experiment the Nassella seedlings competed vigorously with the cocksfoot and formed a dense mixed sward. Cocksfoot became the dominant species in the unburnt plots.

It is concluded that glyphosate can be used effectively against Nassella but that further work will be necessary to define optimum quantities and times of application. 8 litres/ha can be expected to give good results if applied during summer, but as little as 4 litres/ha may prove more economic. Follow-up treatments are essential.

Cocksfoot has proved useful for oversowing treated areas but it forms an open sward that is unlikely to resist re-invasion by Nassella. There is a need to test plants capable of developing a denser cover.

At current (1977) prices the cost of herbicide would be R110 for 8 litres glyphosate and R101 for 40 kg propop. Work in New Zealand has indicated that only 5 to 10 kg propop/ha need be applied if the Nasella is burnt about six weeks after spraying. A follow-up seedling spray, of about 1,7 to 3,4 kg propop/ha would then probably be necessary. The use of this relatively cheap procedure is to be investigated.

SOILS

ALKALINITY STUDIES

W-Sb.139/1:

IMPROVEMENT OF THE SOIL-MOISTURE REGIME AND GENERAL PHYSICAL CONDITION OF BRACK (ALKALINE) AND OTHER PROBLEM SOILS BY THE USE OF DIFFERENT RECLAMATION MATERIALS. 1972-1976

P.C. van Rooyen

The effects of five ameliorants for saline-sodic soil reclamation on certain chemical and physical soil properties over a four-year period of observation are reported. Of these ameliorants, three are in general use (gypsum, sulphur, manure); the other two are for this purpose either unusual (potassium sulphate) or relatively unknown (molasses meal). Results demonstrate that molasses meal had a very rapid-acting favourable effect on most soil physical properties whilst soil chemical conditions remained essentially unchanged. The effect on physical properties was presumably due to soil aggregation by the polysaccharide component of molasses meal but this aggregation does not last long; the very arid climatic conditions under which this experiment was carried out apparently did not favour the preservation of structural bonds consisting of polysaccharide gums. Consequently, a gradual decline of structural conditions set in after the second year. Although initially not as effective as molasses meal, gypsum and sulphur retained their favourable influence on physical properties over a longer period. Potassium sulphate and farmyard manure provided virtually no benefit.

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ANALYSIS

W-Sb.125/3: EVALUATION OF THE SULPHUR CONTENT OF SELECTED SOIL FORMS IN THE WINTER RAINFALL REGION. 1974-1976

C.P. de L. Beyers

An investigation was carried out of the sulphur status (mono calciumphosphate extractable) of selected soil series in the Winter Rainfall Region.

In the Western coastal area (Swartland) of the Region, soil samples were collected in the districts of Wellington, Darling, Piketberg, Malmesbury, Vredenburg and Kraaifontein. The following soil forms and series were each sampled in at least six localities, and the results have been condensed as follows:

TABLE 1 - Description of soils

Soil form	Soil series	Description
1. Fernwood	Sandveld	deep, coarse sand
3. Fernwood	Fernwood	deep, medium sand
4. Kroonstad	Mkabati	medium sand on clay
5. Glenrosa	Kanonkop	shallow sandy loam on phyllites
6. Swartland	Swartland	Sandy clay loam on clay
7. Hutton	Msinga (granite)	highly weathered, red,
8. Hutton	Msinga (shale)	sandy clay loam

TABLE 2 - Sampling localities and approximate annual rainfall in mm

1. Wellington	500
2. Darling	400
3. Piketberg	250
4. Malmesbury	500
5. Vredenburg	350
6. Kraaifontein	450

TABLE 3 - Analyses carried out on soil samples

Sulphur	Mono calcium phosphate extractable (Fox, 1964: Massoumi & Cornfield, 1963)
O.M.	Organic material — Walkley-Black (Jackson, 1957)
S,me	Exchangeable cations per 100 g of clay (unbuffered NH4C1)
pH	1:2 KC1-medium
Clay	Pipette method

TABLE 4A - Analysis of A-horizons

Series and locality		Sulphur (ppm)		% me/100g clay		pH
			OM	Clay	S	
Sandveld	1.1*	6,6	0,28	2,1	58	4,9
	1.2	4,3	0,34	4,1	27	4,4
Fernwood	2.2	3,5	0,39	1,0	145	4,8
	2.6	2,5	0,34	0,8	166	5,5
Katarra	3.1	3,8	0,37	2,6	65	5,0
	3.2	3,0	0,33	2,3	39	4,4
Mkambati	4.2	3,4	0,32	2,2	114	5,1
	4.5	1,8	0,20	2,0	110	6,2
Kanonkop	5.1	4,9	0,59	8,9	19	4,2
	5.4	14,2	0,89	14,3	28	4,7
Swartland	6.1	8,7	0,74	14,0	28	5,0
	6.4	13,3	0,73	11,6	27	4,8
Msinga	7.2	15,6	0,54	12,2	11	4,0
	7.4	19,3	0,67	16,9	17	4,4
	8.3	13,8	0,58	20,8	30	4,9
	8.4	14,3	0,47	12,7	14	4,1

* The figure before the point refers to the soil series (Table 1) and the one after the point to the locality (Table 2)

TABLE 4B - Analysis of B-horizons

Series and locality		Sulphur (ppm)		% me/100g clay		pH
			O M	Clay	S	
Sandveld	1.1	4,1	0,09	1,9	33	4,9
	1.2	4,1	0,10	4,0	21	4,5
Fernwood	2.2	2,3	0,13	0,8	83	4,7
	2.6	2,5	0,10	0,6	162	5,0
Katarra	3.1	2,7	0,17	3,5	27	4,8
	3.2	3,1	0,14	2,6	25	4,6
Mkambati	4.2	2,9	0,17	2,0	58	5,5
	4.5	2,2	0,13	2,4	66	6,1
Kanonkop	5.1	11,0	0,35	14,2	13	4,1
	5.4	24,0	0,60	21,6	19	4,8
Swartland	6.1	74,0	0,38	57,0	15	5,3
	6.4	69,0	0,38	40,0	26	5,3
Msinga	7.2	27,0	0,35	22,3	10	4,4
	7.4	53,0	0,37	32,6	11	4,5
	8.3	52,0	0,36	31,3	6	3,7
	8.4	65,0	0,28	24,8	7	3,8

TABLE 5 - Percentage yield losses obtained with ryegrass in the absence of sulphur as plant nutrient

Soil-series and locality*		1st cutting	2nd cutting	S in soil (ppm)
Sandveld	1.1	- 2%	-39%	1,9
	1.2	- 2	-24	2,7
Fernwood	2.2	- 13	-62	2,3
Katarra	3.3	- 3	-33	2,6
	3.3	- 2	-24	6,1
Mkambati	4.5	+11	-54	4,7
	4.5	- 8	- 9	2,1
	4.2	+10	-22	0,9

*See note Table 4A

The organic matter varies between 0,20 and 0,39 per cent in the sandy soils (series 1-4) and between 0,47 and 0,89 per cent on the sandy loam to sandy clay loam soils (series 5-8). These values are regarded as low and any contribution to the sulphur requirement of crops from this source must be regarded as minimal.

Anderson and Webster (1968) suggested 8 ppm sulphur in soils as a tentative critical level, commenting that soils containing less than 8 ppm were unlikely to supply the sulphur requirement of crops, unless sulphur was supplemented.

With this as criterion, the sandy soils with a sulphur content of between 1,8 and 6,6 ppm (Tables 4 and 5) must be regarded as sulphur-deficient. The soils of the Glenrosa, Swartland and Hutton forms have sulphur contents in the A or B horizons that exceed the suggested critical level.

In pot experiments with the sandy soils, crop losses on ryegrass of between 9 and 62 per cent were measured under a sulphur-free fertilizing programme. It must be pointed out that levels of native phosphorus in these soils are extremely low and that deficiencies of sulphur on crops have not been experienced probably due to the continued use of superphosphate, which contains approximately 13 per cent sulphur.

This investigation has also been extended to the southern coastal plains of the Winter Rainfall Region, where soil samples were collected in the areas surrounding Caledon, Riviersonderend and Bredasdorp. The study included the most important soil forms in these areas, namely Sterkspruit, Valsrivier, Estcourt, Mispah, Glenrosa, Swartland and Shortlands. Each form was sampled according to the main horizons in at least six localities. The average sulphur contents are presented below.

Table 6 clearly illustrates that soils of the Sterkspruit and Mispah (Klipfontein series) forms contain what can be regarded as inadequate sulphur levels. In contrast, soils of the Valsrivier, Estcourt, Mispah (Mispah series), Glenrosa, Swartland and Shortlands forms seem to be well supplied with sulphur.

The findings of this investigation clearly indicate questionable sulphur levels, particularly in the light textured soils of the Winter Rainfall Region. Future fertilizing programmes should therefore carefully consider the sulphur requirement of crops on these soils if crop losses are to be avoided.

TABLE 6 - Average sulphur (ppm) of the main horizons of selected soil forms in the southern coastal area of the Winter Rainfall Region

Soil form	A	B	C
1. Sterkspruit	3,4	9,2	7,4
2. Valsrivier	6,0	17,4	26,8
3. Estcourt	4,6	6,2	30,3
4. Mispah			
(a) Klipfontein	5,4	5,1	—
(b) Mispah	16,4	19,8	—
5. Glenrosa	13,8	19,8	30,7
6. Swartland	14,1	15,0	26,0
7. Shortlands	19,0	24,6	36,3

CHARACTERISTICS

O-Gl.139/1: EFFECT OF MOLASSES MEAL APPLICATIONS ON THE CHEMICAL AND PHYSICAL PROPERTIES OF A MANGANO SOIL SERIES AND ON THE CULTIVATION OF SOME CROPS UNDER IRRIGATION. 1973-1977

A. v. Schalkwyk, J. de V. Nel,
and P.C.J.C. Dendy

A completely randomised block design, consisting of six treatments and four replications was used for testing the effect of different levels of molasses meal applications on the chemical and physical properties of a Mangano soil series and on the production of various crops, under irrigation at the experiment station of the Sand-Vet irrigation scheme.

Amounts of 0; 2,5; 5,0; 7,5; 10,0 and 12,5 tons of molasses meal per hectare respectively, were applied to the experimental plots and ploughed in on 18 April 1973, 14 August 1974 and 1 October 1976. Soil samples were taken for analysis before any treatments were applied as well as nine, ten and four months, respectively, after the different treatments. Samples of wheat plants at the soft-dough stage, the fourth leaves from the growing tips of the potato plants at an early flowering stage and the youngest adult leaves of 125-day-old cotton plants were also gathered for chemical analysis. The harvest yields of the different crops were recorded.

These different parameters were subjected to analyses of variance to establish any possible effects due to the different treatments. The results indicated that the potassium content of the topsoil, as well as the subsoil was significantly affected by the application of molasses meal. This was in accordance with results obtained by Weber & van Rooyen (1971). In contrast with their subsequent results however, no other statistically significant effects due to the treatments were found in this investigation. The absence of differences between factors related to soil structure such as organic-matter content, available moisture, matrix density and water stable aggregates, was conspicuous and highly contradictory to the findings of Weber and van Rooyen.

No explanation for the inability of the treatments to increase the organic matter content of the soil can be given except that there was a very rapid combustion rate under prevailing climatic conditions due to the low clay content of the soil and the small amount of nitrogenous substance in the molasses meal. The failure of the treatments to induce a significant formation of water stable aggregates was likewise difficult to explain and leaching of the polysaccharide gums and carbohydrates due to excesive rains, was suspected.

Furthermore, no statistically significant differences were found in the harvest yields of wheat, potatoes and cotton. The chemical composition of wheat plants, potato and cotton leaves was not influenced by the different treatments. Even on those plots where molasses meal applications resulted in significantly higher potassium levels in the soil, no increase in potassium uptake by the different crops was illustrated. The chemical composition of the different plant materials could be regarded as normal as well as the yields of the wheat and cotton.

It must be pointed out that the potato crop was severely damaged by blight and by waterlogged conditions due to excessive rains. These conditions might have obscured the effects of the treatments but it was definitely not the case with the wheat and cotton crops.

In view of the negative results obtained in this experiment, molasses meal cannot be recommended as an ameliorant for soil structure on the Sand-Vet irrigation scheme or on similar soils under similar climatic conditions.

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Weber, H.W. & van Rooyen, P.C., 1971. Polysaccharides in molasses meal as an ameliorant for saline-sodic soils compared to other reclamation agents. *Geoderma* 6, 233-253.

CLASSIFICATION

(A)S-Pr.6/22:

CLASSIFICATION AND MAPPING OF THE SOILS OF SOUTH AFRICA: PREPARATION FOR PUBLICATION OF A FIRST EDITION OF A NATIONAL SOIL CLASSIFICATION SYSTEM. 1972-1974

C.N. MacVicar, J.M. de Villiers *et al*

"Soil Classification — a binomial system for South Africa." 1977. Pretoria: Govt. Printer.

This book sets out a natural, two-category or binomial system for classifying the soils of South Africa which is designed to facilitate identification. The higher category contains 41 soil forms, each made up of a vertical sequence of diagnostic horizons or materials (not more than four in number) that are generally easy to identify in the field. Altogether there are five topsoil and 15 subsoil diagnostic horizons, each clearly defined in terms of soil properties and briefly discussed in terms of genesis. Soil series (504 in all) within the forms constitute the lower category and are differentiated according to a variety of criteria (texture, base status etc). The series are referred to by geographic names (no two series have the same name), but these are labels with no intrinsic significance, and the form takes its name from one of its constituent series. Each form is illustrated by a colour plate. A glossary of terms and an index are included. Correlations with the FAO and USDA soil classification systems are indicated.

H-Vl.14/5:

SOIL CLASSIFICATION IN DEVELOPMENT AREAS IN HIGHVELD REGION: SOIL CLASSIFICATION IN THE ARGENT DEVELOPMENT AREA. 1974-1976

P.J. Gous, L.M. le Roux, S.W.J. Idema and
O.J. van der Walt

In executing the development programme for the Highveld Region, all the soils in the Argent development area were classified on a series basis with further subdivision into phases. This area is situated in the Delmas district and covers 9 926 ha comprising 38 farming units.

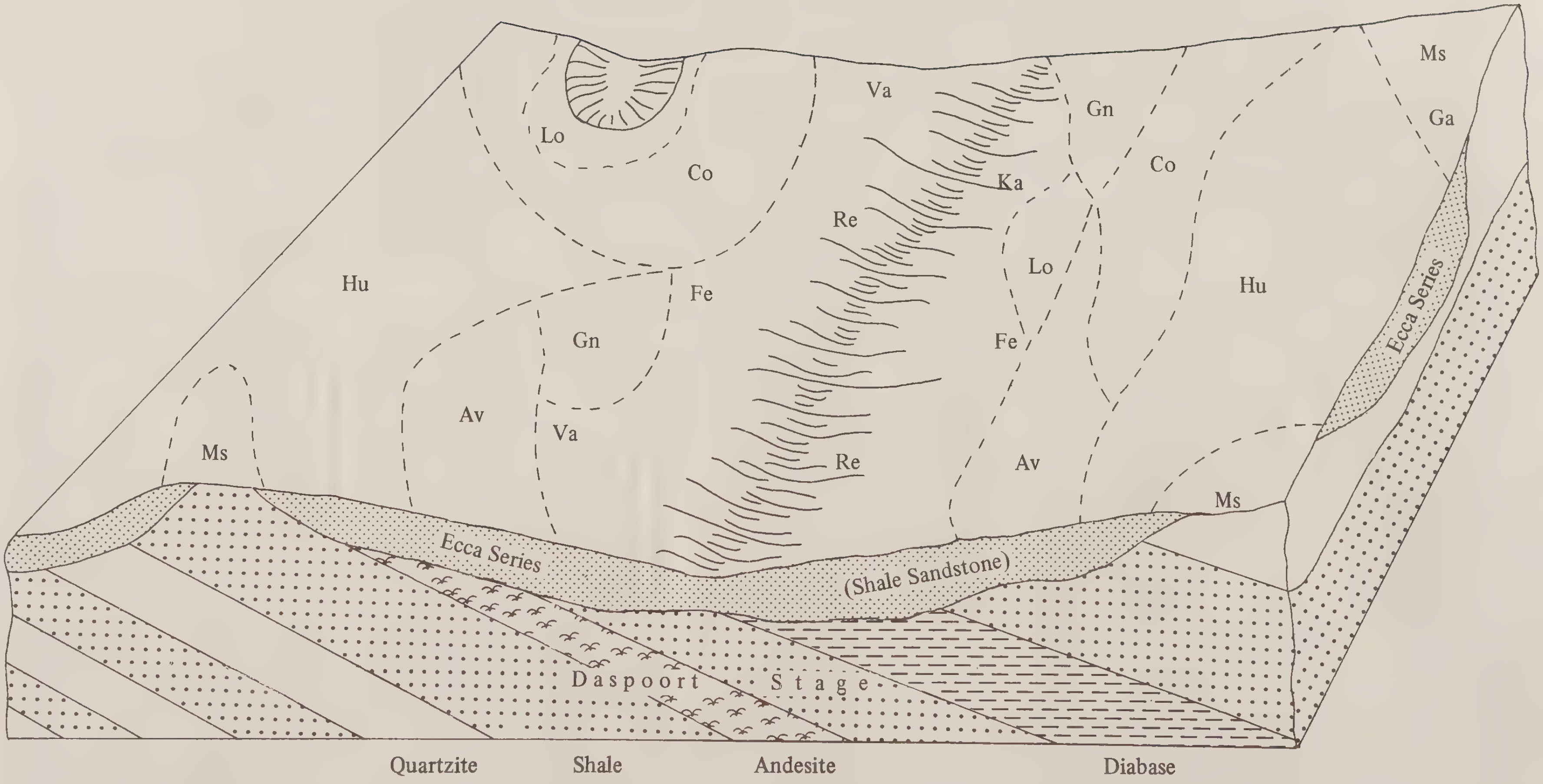
With the binomial soil-classification system for South Africa as a basis, 80 series belonging to 24 soil forms were identified. The collected mapping data was transferred to a photo-mosaic (Scale 1:20 000). This data will also be made available for every independent farming unit by means of a farm map, also on a 1:20 000 scale.

The soils of Hutton, Clovelly, Mispah and Avalon forms together comprise 79,8 per cent of the development area. The Hutton form is dominant, comprising 45,2 per cent, and its soils are mainly represented by an interlaced complex of soil units belonging to the Hutton and Msinga series which comprise 42,1 per cent of the whole area. These soils, like the other red soils and the yellow soils are predominantly medium to highly leached. A distinctive characteristic of most red and yellow soils is the gravelly material distributed throughout the profile, which accelerates the draining and leaching of base-forming cations. From analytical data obtained it is evident that climatic conditions (rainfall, temperature, etc.) cannot be used in isolation to determine the degree of leaching of a soil. Parent material and topography must, under certain circumstances, also be taken into consideration.

The red and yellow soils occur as large continuous units surrounding outcrops of Mispah soils on the crests and midslopes of the landscape, while the lower-lying areas are occupied by at least nine soil forms (Fig. 1). The most representative soil association, on a soil form basis, is Hutton-Clovelly. On a series basis the situation is more complex but the Hutton/Msinga — Oatsdale/Southwold combination (Hu 7/1 / Hu 7/2 - Co 7/1 / Co 7/2) is the most prominent.

The more prominent red and yellow non-cutanic soils differ in texture (in the subsoil) from sandy loam to sandy clay loam and are generally deep. The drastic difference in texture between soils of this development area and those in the North-Western Orange Free State and Western Transvaal is remarkable. The local soils are not only heavier in texture in both the topsoil and subsoil, but there is, almost without exception, no prominent difference in texture between the topsoil and subsoil of these red and yellow soils. As previously stated, local soils are also predominantly acid. As in the Vermaas and Losdorings development areas the presence of high Mg concentrations in the B horizons of especially the red and yellow non-cutanic soils is also a prominant feature in the soils of Argent development area. At the time of the survey 68,5% of the soils in the development area were under cultivation, 29,1% were used for grazing and the rest (2,4%) are odd pieces of land used for homesteads, dams, etc.

High-potential agricultural soils are mainly comprised of Hutton, Clovelly, Glencoe and Griffin forms which total 72,5% of the development area. The remaining 27,5% consists of predominantly low-potential soils comprising 19 soil forms that occur as small detached units except in, and adjacent to,


Ms
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Av
Ms
Ecca Series
(Shale Sandstone)
Daspoort Stage
Quartzite
Shale
Andesite
Diabase

FIG. 1 - Diagrammatic presentation of the distribution of the dominant soil in the Argent development area

the natural drainage systems and marshes (vleis). Of the entire area under cultivation only 69% has a high potential for crop production (effective depth more than 720 mm) whilst 35% of the grazing area and 85% of the odd pieces have a high potential. This clearly shows that the agricultural potential of this development area has not yet been fully exploited and that soils with a high potential are used for grazing and a considerable area of low-potential soils is under cultivation.

The cultivation of cash crops in the development area is favoured by a relatively high and evenly distributed rainfall and a high percentage of deep soils with favourable textural and structural characteristics. There are, however, serious limitations which have to be considered by the progressive farmer wishing to exploit these favourable soil/climate conditions to the optimum. The most important of these is soil acidity which is a serious problem in both topsoil and subsoil, over large areas and, as previously stated, most red and yellow soils are medium to highly leached with corresponding low pH values and high lime requirements. These high lime requirements often exceed 4 tons/ha in order to increase the pH (H_20) of the upper 150 mm of soil to 6,2. It is obvious therefore that liming programmes should receive urgent attention.

Water erosion is another substantial problem in most high-potential soils of this area and approximately 54% of all the soils are too shallow to be classified as a class I soil. Thus when grouping into land units it will be necessary to differentiate within series on a basis of soil variants as well as soil phases.

The sequence of series as observed in the landscape, the pattern of surface distribution and the anomalous characteristics of series observed in the development area apparently occur to a wide extent throughout the Delmas district, as well as in the adjoining districts. In this area soil mapping has already been done on a reconnaissance basis with the delimitation of pedosystems and it therefore follows that the soil data obtained in this development area are also applicable to the larger area covered by the relevant pedosystem, *viz* the Dryden pedosystem.

W-Sb.147/2: OPTIMAL RESOURCE UTILISATION IN THE WINTER RAINFALL REGION: CLASSIFICATION AT SERIES AND PHASE LEVEL OF THE SOILS OF THE HEX RIVER VALLEY. 1975-1977

D.J. le Roux and C.J. Watts

The cultivate land of the Hex River Valley was classified at series and phase level and mapped to a scale of 1:10 000. Physical and chemical analyses were carried out to refine the subdivision:

The main soil types are Fernwood, Clovelly, Dundee and Westleigh. The most important physical limitations of the sandy soil types are limited water holding capacity and stoniness, while excessive soil moisture limits the use of the Westleigh soils. A low calcium status is the major chemical limitation to table grape production.

FERTILIZERS

N-Ce.106/4: FERTILITY STUDIES OF THE MAJOR SOIL SERIES IN NATAL: A FIELD-SCALE TEST OF EXPERIMENTALLY ESTABLISHED ECONOMIC OPTIMA FOR N, P, AND K ON AN AVALON MEDIUM-SANDY-LOAM. 1971-1974

M. Farina, P. Channon and G. de Lange

In fertility experiments many of the most important practical limitations to crop production are of necessity eliminated. Fertilizer is spread by hand to obtain as even a distribution as possible, seed is planted by hand to obtain a near perfect stand, hand labour is used to ensure that weed competition is effectively removed, and copious use of labour during harvesting ensures total recovery of the crop. In short, every effort is made to optimise all the production factors which are not involved in the study. Many of the procedures followed are thus impracticable and considerable adjustments must be made when experimental results are put into practice.

Between 1966/67 and 1970/71 efforts were made at the Dundee Research Station to determine the optimum rates of N, P, and K fertilization for maize on the sandy Avalon soils of Northern Natal. Results obtained were considered useful and a fertilization programme for maximum profits per hectare was developed. The experimental results indicated that long-term yields averaging between 5 800 kg/ha and 6 400 kg/ha are possible at Dundee.

Due to the gap between small-plot experimentation and field practice, however, doubts remained regarding the validity of these data on a field scale. The quantities of fertilizer recommended were very much higher than those commonly used by farmers and the financial risk would have been quite unacceptable without further supporting evidence of success.

To obtain such evidence it was, therefore, decided in 1971 to plough 11 hectares of virgin veld and to test the experimental recommendations under field conditions. In this exercise, high fertility ranges were compared with rates commonly used by farmers on similar soils (referred to hereafter as farmer ranges); the net profits obtained in both cases were also compared. Since money invested in fertilizer is wasted unless the other aspects of maize production are optimised, efforts were made to ensure correct plant stands and good weed and insect control. Adapted cultivars were used and cultural operations were similar to those used by most farmers.

To obtain much-needed information regarding the profitability or otherwise of chemical weed control, a further comparison between mechanical and chemical weed control was introduced in 1972. The weed problem was not serious, since the land was a new one, but it was hoped that meaningful differences between the two systems would develop as the weed populations built up.

This exercise has now been in progress for four years and it is considered, in the light of the seasonal variability experienced, that an overall analysis of the results may have real value.

The pre and post-fertilization soil-test data together with the P soil-test levels aimed at in each season are shown in Table 1. Quantities of fertilizer actually applied are shown in Table 2. It should be noted that although the initial P applications were very heavy, the requirement decreased rapidly as the result of P build-up. It is also noteworthy that it proved possible to fertilize to within 1 ppm of the amount indicated by the P soil-test. It should be pointed out that although boron and zinc were used, experimental evidence now indicates that these elements were not actually required.

TABLE 1 - Soil analytical data (High-fertility ranges)

	pH (KCl)	pH (H_2O)	P (ppm)	P target	Exch. cations (me%)			
					Ca	Mg	K	Al
Before fert. 1971	4,2	5,5	4		0,46	0,42	0,18	0,30
After fert. 1971	4,7	5,4	26	25	1,36	0,59	0,32	0,10
Before fert. 1972	4,4	5,5	12		0,80	0,38	0,19	0,22
After fert. 1972	4,3	5,0	20	21	0,84	0,46	0,28	0,18
Before fert. 1973	4,5	5,4	13		0,75	0,35	0,20	0,21
After fert. 1973	4,2	4,8	19	19	0,89	0,41	0,26	0,24
Before fert. 1974	4,2	5,0	13		0,82	0,35	0,21	0,21
After fert. 1974	4,1	5,1	17	18	0,89	0,42	0,22	0,21

TABLE 2 - Fertilizer applications (kg/ha) actually applied)

Ranges	Year	N	P	K	Zn	B	Lime
High-fertility	1971	120	131	42	-	1,8	1 000
	1972	121	64	43	7,5	1,3	-
	1973	129	41	28	5,0	1,0	-
	1974	139	32	37	-	-	1 000
"Farmer"	1971	60	23	15	-	-	1 000
	1972	61	32	22	3,8	-	-
	1973	65	38	26	4,5	1,0	-
	1974	69	36	24	-	-	1 000

Average yields per hectare over the four years of experimentation were 63% higher in the ranges fertilized according to soil test (Table 3).

Comparison of chemical and mechanical weed control in the 1972/73 season was inconclusive. However, during the 1973/74 and 1974/75 seasons (by which time weed populations had built up) overall chemical weed control proved markedly superior to mechanical control (Table 3). During the 1974/75 season, when excessive rainfall made adequate mechanical control difficult, the difference was particularly marked and net losses were realised on these ranges.

It should be noted (Table 3) that:

1. The yields obtained in those high-fertility ranges which received chemical weed control were very close to the predicted yields. Yields between 5 800 kg/ha and 6 400 kg/ha were predicted and the

average obtained over the four seasons actually exceeded 6 000 kg/ha. Since the four seasons were rather variable, the closeness of the predicted and actual yields is considered satisfactory.

2. Returns from maize on sandy Avalon soils can be very good provided adequate quantities of fertilizer are used. It is particularly noteworthy that returns from the farmer range over the four seasons were approximately half the return realised on the high-fertility ranges.
3. In the 1973/74 and 1974/75 seasons chemical weed control, which is relatively inexpensive on sandy soils, increased net profits by approximately R86 per hectare on average. In the 1974/75 season, however, mechanical weed control ranges made an average *loss* of R58-00 per hectare.

TABLE 3 - Dundee demonstration lands — data averaged over four seasons (1971/72 - 1974/75)

	High-fertility ranges with chemical weed control	"Farmer" range with chemical weed control	High-fertility ranges with mechanical weed control **
Yield (kg/ha)	6 088	3 734	3 517
(Yield 91 kg bags/ha)	68	41	39
Plant population/ha	33 400	33 600	36 000
Fixed costs/ha (Ploughing, spreading fertilizer, planting, cultivation etc.)	R25-40	R23-66	R34-37
Variable costs/ha (fertilizer, chemicals, hail insurance, harvesting, bags, transport, etc.)	R142-81	R93-23	R123-68
Total cost/ha	R168-21	R116-89	R158-05
Gross income/ha	R279-78	R174-53	R183-33
Net income/ha	R111-57	R57-64	R25-28
Return on investment (land valued at R150 per hectare, repayments at 10% p.a.)	61%	44%	15%
Cost per 91 kg bag*	R3-16	R3-78	R5-24

* The cost/price structures obtaining in each of the three seasons were used, e.g. maize prices were R34,60/ton in 1972, R45,50/ton in 1973, R50,00/ton in 1974, and R56,00/ton in 1975.
** 1973/74 and 1974/75 seasons only.

It should be noted that in many farm situations net profits could have been considerably higher. Combining was done at a contract price, maximum rate of hail insurance was considered payable in each season, grain was delivered in bags, and the costings used for field operations were those that would have applied to new machinery and equipment.

Publication:

Farina, M.P.W., 1975. Does soil testing pay in practice? *J. Fert. Soc. S.Afr.* 1, 81-86

W-Sb.149/2: NEUTRALISING EFFICIENCY OF THE VARIOUS PARTICLE SIZES OF A SHELL LIME. 1975-1977

C.P. de L. Beyers

An analysis of approximately 1 000 soil samples taken in the southern coastal plains of the Winter Rainfall Region has revealed the following regarding the distribution of soil pH:

Soil pH (KCl)	Percentage of samples
less than 4,3	13,6
4,4 — 4,7	37,7
4,8 — 5,2	32,8
over 5,3	15,9

In order to ameliorate the acid condition of these soils, knowledge of the relative neutralizing qualities of commercial liming materials is essential.

Two lines of investigation were followed:

1) Comparison of the neutralizing efficiency (NE) of the various particle sizes of dolomite, calcite and shell lime.
2) NE of dolomite, calcite shell-lime and some other liming materials on acid soils.

In the first investigation the materials were fractionated into the respective particle sizes (Table 1). The NE of the particle sizes was studied by quantifying the evolution of NH by boiling 2,5 g of the material in 250 ml $5N:NH_4Cl$. The procedure of Shaw and Robinson (1959) was followed and the main results are presented in Figure 1.

TABLE 1 - Particle size distribution and corresponding $CaCO_3$ equivalent (percentages of dolomite, calcite and shell-lime used in this study

Particle size	Dolomite	Calcite	Shell-lime
1,70-0,83 mm	31,0	17,0	0,3
$CaCO_3$: eq.	44	62	17
830-500 microns	16,2	13,4	11,7
$CaCO_3$: eq.	50	76	74
500-250 microns	16,2	16,4	68,0
$CaCO_3$: eq.	70	84	77
250 microns	36,6	53,2	21,0
$CaCO_3$: eq.	90	66	68

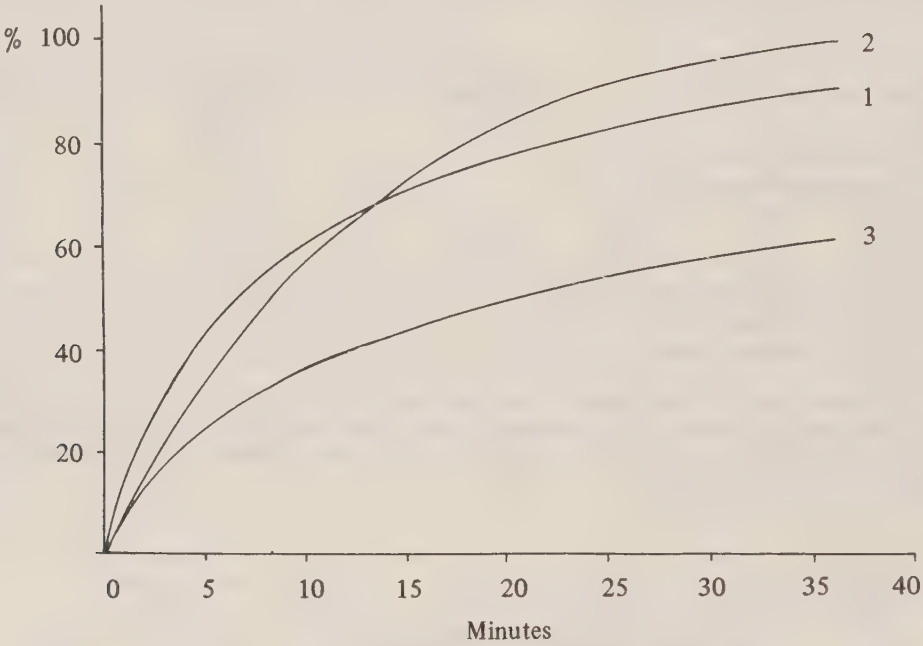

FIG. 1 — The relative rates of neutralization for commercial calcitic lime (1), shell-lime (2) and dolomitic lime (3), according to Shaw & Robinson

According to Figure 1, the relative rates of neutralization of commercial calcitic lime and shell-lime were found to be comparable, while the rate for dolomitic lime was markedly slower.

Further studies indicated that the relative rates of neutralization decreased as particle sizes increased (Figure 3). The neutralizing efficiency of the various particle sizes of dolomitic, calcitic and shell-lime were rated as shown in Table 2.

TABLE 2

Particle size	Dolomite	Calcite	Shell-lime
100 microns	3	1	2
100-250 microns	3	1	2
250-500 microns	3	1	1
500-830 microns	3	2	1
0,83 - 1,7 mm	3	2	1

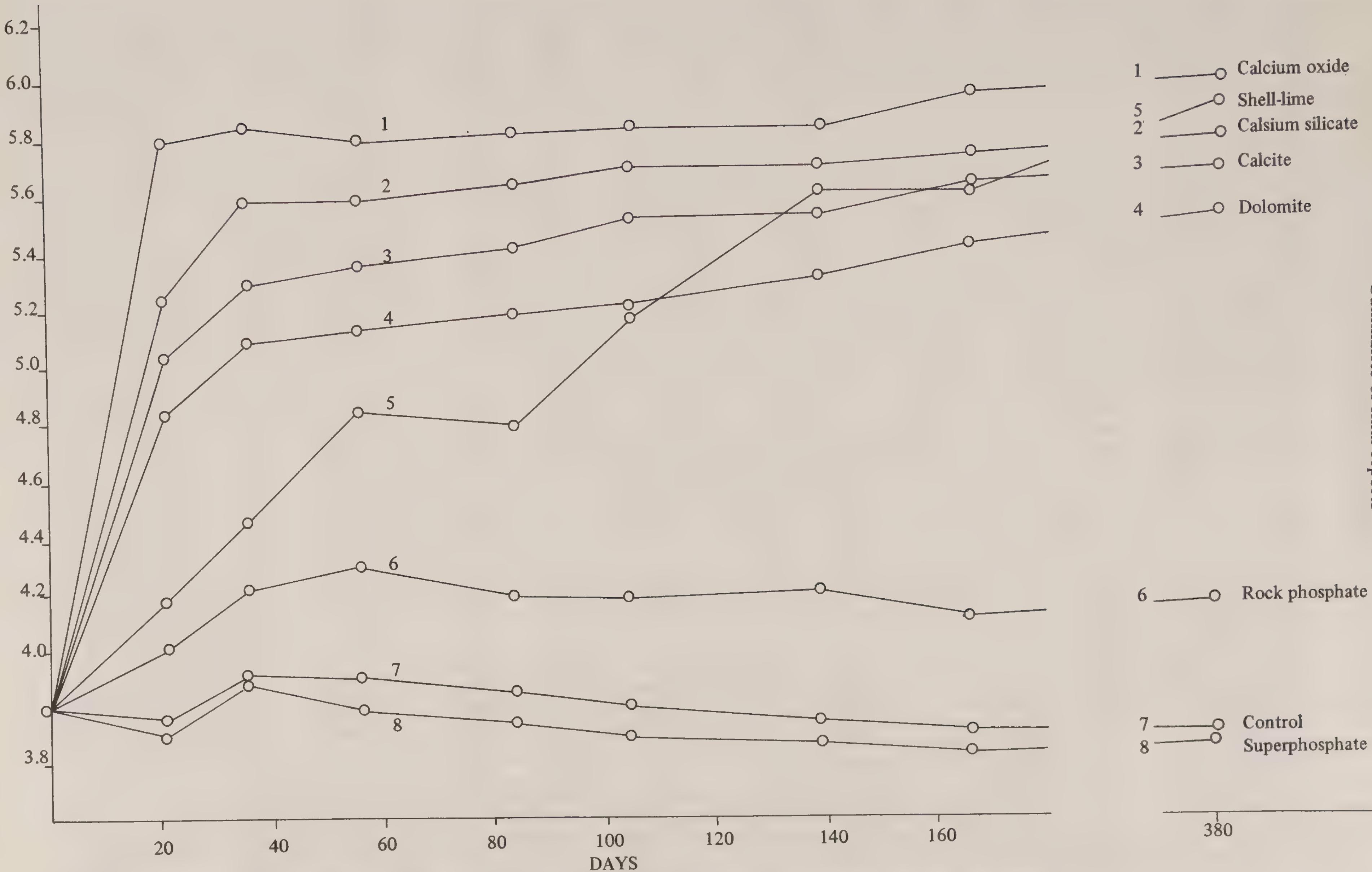

FIG. 2 - Changes in pH of a Hutton soil after application of various materials equivalent to 3 kg of calcitic lime per 1 000 kg soil

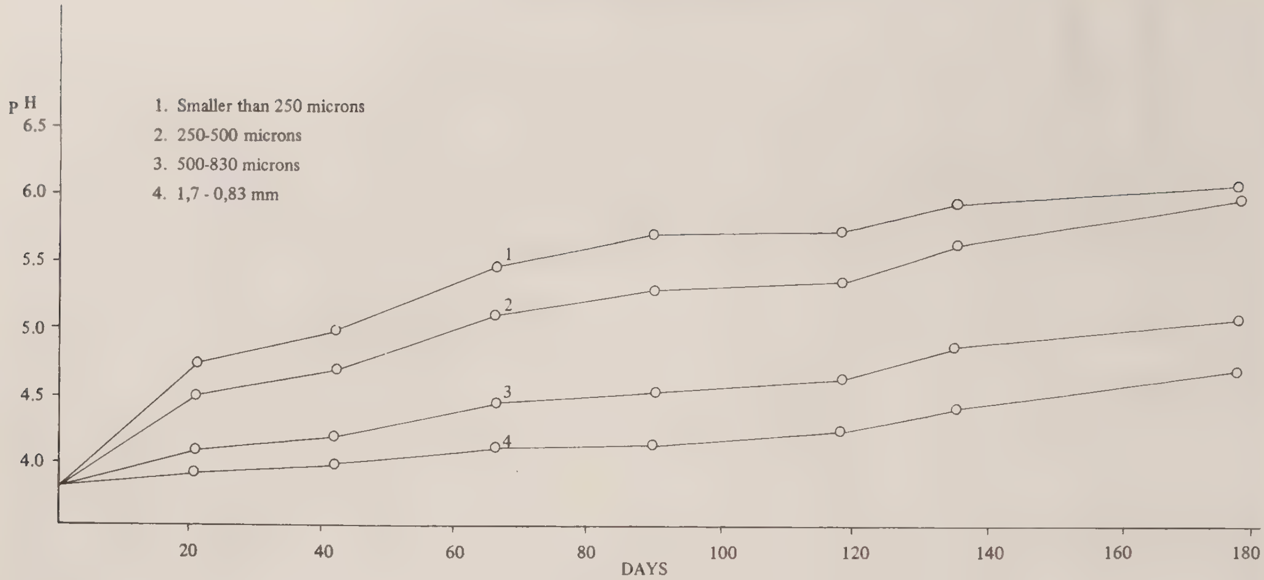

FIG. 3 - The effect of various particle size fractions of shell lime on the pH of a Dundee soil

The results indicate that the neutralizing efficiencies of shell-lime and calcitic lime are similar, with dolomitic lime invariably inferior to the other two.

Another finding was that for the fraction 250-500 microns i.e. slightly larger than the 250 micron fraction which is prescribed by law for the purpose of controlling fineness), shell-lime was a shade better than calcitic lime. Results also indicated that the NE of the respective commercial materials corresponded more closely with that of their 250-500 micron fractions than with that of the smaller-than-250-micron fraction. This is of considerable practical importance.

In the second investigation, two pot experiments were carried out on Dundee (pH 3,8 and 12% clay) and Hutton (pH 4,0 and 33% clay) soils. Liming materials were incubated with moist soil in sealed containers and changes in soil acidity were measured periodically.

For both soils very close negative relationships were found between exchangeable acidity (K_2SO_4) and soil pH, when liming or other neutralizing materials were used. Although rock phosphate as well as superphosphate were able to increase exchangeable Ca + Mg to the same levels as the liming materials, both failed to decrease exchangeable acidity in the Hutton soil.

The changes effected in the pH values of the Hutton soil are illustrated in Fig. 2 It is clear that the major part of the neutralizing reaction of the liming materials is completed within 20-40 days in moist soil. In comparison the shell-lime shows an initial slower rate of neutralization but obtains a comparable effect after about 100 days.

In the field trials, the results again indicate that the final neutralizing efficiency of shell-lime is equivalent to that of dolomitic or calcitic lime, but that the rate of neutralization for liming materials is dependent on an adequate level of soil moisture.

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IRRIGATION

N-Ce.127/1: SURVEY OF THE QUALITY OF IRRIGATION WATER IN THE NATAL REGION. 1972-1977

A. Cass

A survey of the chemical composition of Natal rivers was conducted to characterise irrigation water quality in the Region. Sites selected for analysis were confined to headwaters of important irrigation water sources or near important or potentially important irrigation areas in the interior of Natal. Samples were analysed for Ca, Mg, Na, Cl, CO_3, HCO_3 and SO_4; electrical conductivity was determined and sodium adsorption ratio (SAR) values were calculated.

Recent developments in the field of the quality evaluation of irrigation water have emphasised that absolute standards of water quality do not exist but standards must be related to local environmental factors. Accordingly, a simple model was proposed which allowed soil salinity and sodicity (electrical conductivity and SAR) to be calculated for poorly drained, alkaline (pH 8,4), soils from irrigation water characteristics, rainfall, evapotranspiration and management factors. Each sampling site was thus defined in terms of four variables, namely water salinity and sodicity and soil salinity and sodicity. The sites were then grouped into four classes in terms of salt tolerance of common agricultural crops grown in Natal and the limits of sodicity at which structurally stable and unstable soils maintain hydraulic conductivity at high values (SAR 5 and 15 respectively).

Assessment of river-water quality in terms of the most recent criteria* for irrigation water indicated that only abut half the sites (58%) showed $NaCO_3$ levels that fall in class 1. This means that the remaining waters are not regarded as unsuitable for irrigation, but should be critically examined in relation to local conditions before being recommended for use. The proportion of sites in class 1 for other quality parameters ranged from 100% for C1, 90% for SAR, 70% for sodium content (% of cations) and 77% for electrical conductivity. Three sources of irrigation water, the Mzinyashana headwaters, Wasbank river and the lower reaches of the Mkuzi river are totally unsuitable for irrigation since one or more parameters fall in class 6. The conclusions drawn from classifying the waters in terms of these criteria are confirmed by grouping the river and soil water concentrations in terms of the tolerance limits of common crop plants and the generally accepted limits of soil sodicity (SAR 5 and 15).

Waters falling in group 1 show salinity and sodicity values below the maximum value at which lucerne, maize, citrus, and sugar-cane (salt-sensitive) can be produced without a yield reduction due to osmotic stress and below an SAR of 5, the limit of sodicity generally accepted for soils which are structurally unstable. It is noteworthy that only 45% of the waters examined in Natal fall with this group: This means that only a proportion of irrigation waters may be used on soils with poor drainage rates and alkaline reactions under the climatic conditions specified, without danger of yield reduction or soil deterioration.

Sites tending to have characteristics conducive to development of high salinity in poorly drained soils, but which have relatively little $NaCO_3$ fall into group 2 (19% of the waters analysed). These waters may be used for the production of salt-tolerant crops such as wheat and cotton on all soils, but are unsuitable for salt-sensitive crops on poorly drained soils.

Group 3 waters (21%) have a high potential salinity and contain sufficient $NaCO_3$ (low pH) to render them an irrigation risk on soils having an alkaline reaction and poor drainage, but may be suited to the production of salt-tolerant crops (cotton and wheat) on well-drained soils. However, the low salinity of some of these waters, coupled with a high potential, may introduce hydraulic conductivity deterioration in soils of unstable structure.

Group 4 waters (14%) which include those previously judged unsuitable for irrigation, as well as the minor tributaries of the Tugela river, at Tugela Ferry, the lower reaches of the Nkongolwana and the upper reaches of the Mqualusini river, are not suitable for irrigation of poorly drained soils and will probably present a hazard on well-drained soils as well.

The general pattern of water quality shows that the majority of the larger rivers in the interior of Natal have an irrigation-water quality that is good by all standards, particularly in central and southern Natal. Some of the larger rivers in northern Natal are of rather poorer water quality (Pongola and Mkuzi rivers) and thus indiscriminate irrigation in these catchments should be avoided. In contrast, many of the smaller rivers throughout Natal show poorer quality and this may have important consequences for smaller irrigation enterprises. The survey did not include irrigation water from sources close to the Natal coast, but a steady deterioration in water quality occurs downstream for most of the Natal rivers, so that the foregoing reservations with regard to the use of some Natal waters for irrigation of poorly drained soils are probably applicable to the coastal region as well.

Reasons for the variable pattern in water quality in Natal must be sought in the distribution of coal mines, in the nature of the surface geology and in the presence of saline groundwater in certain parts of the region.

The presence of extensive coal fields in northern Natal (Dundee, Newcastle, Utrecht and Vryheid districts) means that the headwaters of the Wasbank, Buffalo, Mfolozi, Mkuze, Pongola, Sundays and Tugela rivers are considerably disturbed by effluents draining from active and abandoned mines. This is inferred from abnormally high SO_4 contents of effluents and river water, although mine effluents from the Dundee area appear to be more alkaline, containing less sulphate and more carbonate. Consequently rivers in the Vryheid area tend to fall into group 2 waters while rivers in the Dundee area tend to fall into

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*Christian, J.E., Olsen, E.C. and Willardson, L.S., 1977. Irrigation water quality evaluation. *Journ. of Irrigation and Drainage Division, ASCE.* 103, 155-169.

groups 3 or 4. Despite the fact that the effect of mineralisation diminishes downstream from the mining areas owing to a flow of unpolluted water from tributaries, it does not entirely disappear. This is because the acidity of mine effluents tends to be neutralised by calcium carbonate in the sediments and rocks of the river beds thereby increasing the carbonate load of the water. The best example of this phenomenon is to be found in the Mkuzi river catchment, where calculated soil water salinity decreases downstream, but soil water sodicity increases. The quality of the river therefore shifts from group 2 at the Mkuzi headwaters to group 3 near Magut, a change which must be interpreted as water quality deterioration.

The second factor affecting river-water quality is surface geology. The Mpushini, Mlazi and middle reaches of the Mkuzi river traverse extensive tracts of Dwyka series, while the Sterkspruit and Pongola rivers cross granite outcrops. These rivers have chemical characteristics which make them a hazard for irrigation of salt-sensitive crops and poorly drained, alkaline soils.

In addition the lower Mkuzi river appears to be influenced by an additional factor which may be the saline groundwaters found in this area. These groundwaters, with more than 750 mg/ℓ total solids may also have an adverse effect on the lower reaches of the Pongola, Black Mfolozi, White Mfolozi and other smaller rivers.

MICROBIOLOGY

(A)PS-Pr.34: VESICULAR-ARBUSCULAR MYCORRHIZAE. 1970-1975

F.C. Wehner, S.M. Dutrieux & D.L. Botha

A survey was made of the occurrence and distribution of endomycorrhizae and spores of the Endogonaceae in the summer rainfall area and the factors influencing them were investigated. An investigation was also made of the effect of inoculation with two of the Endogonaceae isolates on plants under divergent conditions.

Endotrophic infection was rarely encountered in the field, though Endogonaceae spores were quite frequently isolated from the soil. Time of the year and other environmental factors had a pronounced influence on the occurrence of endogonaceae spores. Nine Endogonaceae isolates were encountered *viz. Gigaspora calospora, G. gigantea, Glomus mosseae, G. fasciculatus, G. macrocarpus* var *geosporus* and four unidentified isolates. The incidence of Endogonaceaespores was not correlated with the general microbiological and fungistatic nature of the soil. Seasonal fluctuations in spore numbers (though with differing patterns) occurred during the two successive years in which surveys were carried out. Prolonged application of phosphorus and manure to a field soil apparently caused a decrease in Endogonaceae spore numbers and endomycorrhizal infection of maize.

Under greenhouse conditions, *Gigaspora calospora* and *Glomus mosseae* infected a limited number of plant species.

Inoculation of maize with *Gigaspora calospora* resulted in an increase in the growth rate of the plants in a sand and soil mixture containing more sand than soil. In soil containing no sand the association was pathogenic.

Inoculation of maize with *Gigaspora calospora* and *Glomus mosseae* increased the growth of the plants initially, but later had an inhibitory effect on the plants. Inoculation with *G. calospora* caused a decrease in the phosphorus content of the plants, whilst inoculation with *Glomus mosseae* resulted in an increase.

The seed yield of maize was not influenced by inoculation with *Gigaspora calospora* but was increased by inoculation with *Glomus mosseae*. Inoculation with *G. mosseae* caused a decrease in the shoot yield of lucerne if the lucerne was cut regularly.

Application of lime to the soil had no effect on the infectivity of *Glomus mosseae* to maize.

Inoculation of maize with *Gigaspora calospora* as well as *Glomus mosseae* caused a decrease in the relative turgidity of the plants under conditions of drought.

Infection of maize by *Gigaspora calospora* and lucerne by *Glomus mosseae* was more effective at high than at low temperatures. Under high temperature conditions *Gigaspora calospora* was pathogenic to maize whilst *Glomus mosseae* increased the growth as well as the phosphorus content of lucerne. In this case the lucerne was not cut regularly.

Glomus mosseae was sensitive to more fungicides than was *Gigaspora calospora*.

In one experiment inoculation with *Gigaspora calospora* and *Glomus mosseae* caused a decrease in the pathogenic infection of maize by *Drechslera pedicellata*, but increased it in another. Inoculation with *Gigaspora calospora* and *Glomus mosseae* increased the severity of infection of lucerne by *Corynebacterium insidiosum*, but increased the growth of the plants to such an extent that the detrimental effect of the bacterial infection was eliminated.

Endomycorrihizal infection had no effect on the intensity of infection of wheat by *Puccinia graminis* f. sp. *tritici*, of beans by *Pseudomonas phaseolicola* and lucerne by *Phoma medicaginis*, though it appears to predispose wheat to infection by *Ustilago nuda*.

RADIO ISOTOPES

(S)WP.145/2: METHODS FOR THE RADIOMETRIC ASSAY OF BIOLOGICAL MATERIAL AND SOILS: DETERMINATION OF HALF-LIVES OF RADIO ISOTOPES. 1962-1977

J.M.H. Karsten, P.G. Marais, F.J. Haasbroek C.J. Visser

The half-lives of more than 20 radio-isotopes which are of importance in agricultural research, were investigated. As far as possible the decay of each sample was studied for a period of at least five half-lives and a sufficient number of counts were accumulated in each reading to obtain a standard deviation better than 0,2%. The frequency of the readings was determined by the half-life of a particular radio-isotope.

Resolving-time losses in count rates were accounted for by assuming a constant resolving-time as determined by the two-source method, or by employing the relative-activity technique. After corrections for resolving-time losses and background radiation, all readings were normalized in terms of readings taken with a standard source.

Depending on the activity, type and energy of the different radio-isotopes, a well-type scintillation counter, Geiger-Müller liquid and end-window counters, a gas-flow counter, a liquid scintillation counter or a dosimeter, were employed in the half-life determinations.

The source preparation technique applied depended on the type of detector used. Sealed or open liquid and solid sources, as well as sources mounted in Perspex, were prepared. The majority of determinations were done in a well-type scintillation-counter and it was found that the most durable sources were produced by drying the radioactive solution on a piece of filter paper and sealing it in a Perspex cylinder.

The half-lives of the isotopes were computed by fitting a linear regression between the logarithm of the corrected count rates and the decay time. The slope (b) of this relationship was used to calculate the half-life (T) of the sample, using the formula:

$$T = \log 2/b$$

In several half-life determinations, problems were encountered due to the presence of long-lived

TABLE 1 - Half-lives and relevant data for a number of nuclides

Nuclide	Half-life period	Detector	Source preparation	Half-life — standard error*
^{24}Na	4,1	Liquid scintillation	Liquid plus scintillator	15,55 ± 0,05 h
$_{32}$P	6	Geiger-Müller liquid	Liquid	14,28 ± 0,05 d
^{45}Ca	3	Gas-flow	Mounted on Perspex	163,0 ± 0,6 d
^{51}Cr	6	Well-type scintillation	Sealed in Perspex	27,70 ± 0,02 d
^{51}Cr	6	Well-type scintillation	Sealed in Perspex	27,75 ± 0,03 d
^{54}Mn	5	Well-type scintillation	Sealed in Perspex	315,4 ± 0,01 d
^{59}Fe	6	Well-type scintillation	Sealed in Perspex	44,75 ± 0,04 d
^{60}Co	1,1	Dosimeter	Solid	5,252 ± 0,007
^{65}Zn	4	Well-type scintillation	Sealed in Perspex	244,52 ± 0,007 d
$_{86}$Rb	6	Well-type scintillation	Sealed in Perspex	18,82 ± 0,02 d
^{113}Sn	6	Well-type scintillation	Sealed in Perspex	115,7 ± 0,4 d
^{131}Cs	5	Well-type scintillation	Sealed in Perspex	9,71 ± 0,01 d
^{131}I	6	Well-type scintillation	Sealed in glass and Perspex	8,031 ± 0,004 d
^{132}I	5,5	Well-type scintillation	Liquid	2,285 ± 0,001 h
^{134}Cs	4	Well-type scintillation	Sealed in Perspex	2,10125 ± 0,00004 y
^{137m}Ba	3	Well-type scintillation	Liquid	153,08 ± 0,04 s
$_{182}$Ta	6	Well-type scintillation	Sealed in Perspex	114,74 ± 0,08 d
$_{192}$Ir	1	Well-type scintillation	Sealed in Perspex	74,4 ± 0,3 d
$_{198}$Au	5	Well-type scintillation	Solid	2,693 ± 0,002 d

* Error = Standard error from least squares fit x 3,3

contaminants in the samples. The contaminants were identified by means of a multi-channel analyzer and where the half-life of the original isotope was short, the decay of the contaminant followed after complete decay of the original isotope. By extrapolation of this the original data were corrected for the presence of the contaminant and the half-life was calculated. However, where both the isotope and the contaminant had long half-lives, it was impractical to employ this method and the two superimposed exponential decay curves were stripped by means of a computer program.

The results of the half-life determinations of several radio-isotopes are presented in Table 1.

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SALINITY

W-Sb/139/4:

THE BEHAVIOUR OF A COMPACTED AND SALT-AFFECTED FINE SANDY SOIL IN THE RIVERSDALE AREA AFTER TREATMENT WITH CERTAIN CHEMICAL AND ORGANIC AGENTS. 1975-1977

J.H. Moolman

A field experiment was carried out at Riversdale (Cape Province) to investigate the feasibility of increasing crop yields and lowering the irrigation-water consumption on a compacted, saline fine sandy soil by changing the soil environment. It was also hoped to find an economically feasible method of reclamation of such compacted saline soils.

Six treatments involving the addition of various quantities of gypsum to the irrigation water over different periods of time, a 7th treating the soil surface with molasses meal and an 8th treatment involving a poli-acry-amide (PAM) solution, were applied.

All the treatments were successful in leaching the excessive soluble salts and reducing the excessive sodium percentage of the soil, but these favourable changes were unfortunately accompanied by a deterioration in the physical nature of the soil, as measured by the infiltration rate.

This last rather unexpected result was then investigated by means of a threshold concentration curve constructed in a laboratory experiment. (Fig. 1) Threshold concentration is defined as the electrical conductivity (or electrolyte concentration) of the percolating solution at which a 15% reduction in permeability, relative to the maximum permeability, will occur. If the electrolyte concentration is less than this critical value, clay swelling and clay dispersion will occur, with the result that the macropores of the soil are either reduced in diameter or blocked by the dispersed clay particles.

From Fig. 1 it can be seen that, for example, in a fine sandy soil with an ESP of 10 either the electrical conductivity of the percolating water (EC) or the electrical conductivity of the soil solution (EC$_e$) must exceed 0,6 milliSiemens per centimetre (mS/cm) to prevent clay dispersion. It was found that the excessive soluble salt of the field plots at the start of the investigation prevented clay dispersion, but as soon as the plots were irrigated with the low electrolyte water that was available the electrical conductivity of the soil extract (ECe) and the exchangeable sodium percentage (ESP) were lowered. Because the reduction in ESP was comparatively less than the reduction in EC$_e$, most of the ESP- EC$_e$ combinations in the stable area (Fig. 1) now moved into the unstable area. As the EC of the irrigation water was only 0,12 — 0,16 mS/cm, clay dispersion occurred and the soil pores were blocked. By adding gypsum (0,53g/ℓ) to the water with every irrigation the EC was raised to 0,6 mS/cm which is sufficient to prevent clay dispersion on fine sandy soils with ESP$<$11.

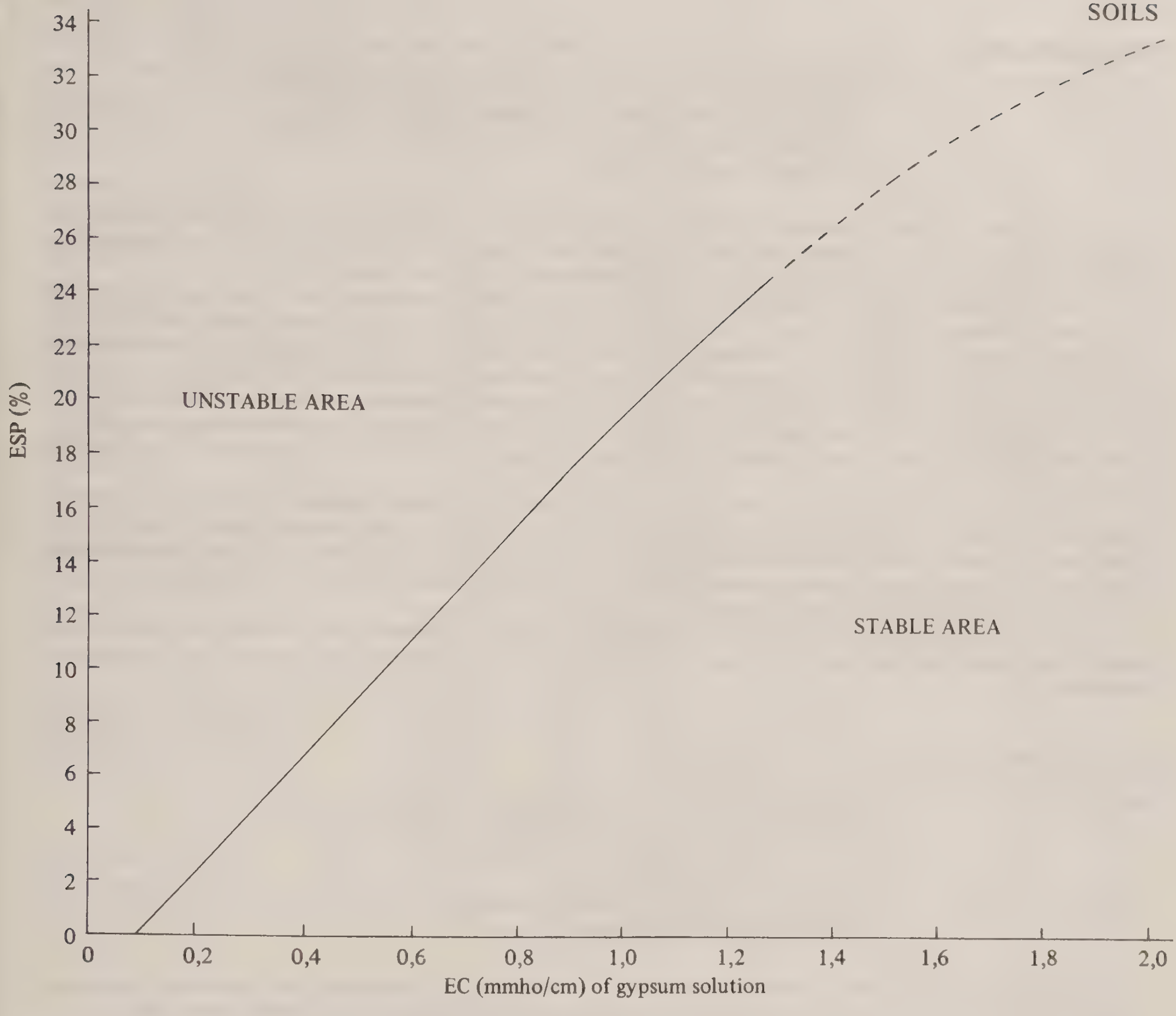

FIG. 1 - Threshold concentration curve for oakleaf fine sandy soil

The investigation proved that by adding small quatities of gypsum to low-electrolyte irrigation water the excessive salt of a saline-sodic soil could be leached and the exchangeable Na replaced by Ca . As such the soil could be chemically reclaimed. The presence of gypsum in the irrigation water prevented the deterioration of the physical structure of the soil and thus the soil maintained a reasonable infiltration rate. This resulted in 23% increase in lucerne yield over the control.

It was also shown that:

1. Chemical reclamation of a saline-sodic fine sandy soil does not necessarily lead to an improvement in the physical structure — especially so if the electrolyte concentration of the irrigation is low.
2. By adding molasses meal to the soil a short-term improvement in the physical structure will occur — however, this is not economically feasible;
3. PAM is too water-soluble to have any lasting effect on soil structure;
4. When fine sandy, saline-sodic soils are brought under irrigation the infiltration rate will inevitably drop if the electrolyte concentration of the irrigation water is low, as is the case with the Corrente-Vette river irrigation scheme near Riversdale.

It is thus recommended that where a saline-sodic fine sandy soil is to be reclaimed the gypsum requirement should first of all be determined, and the gypsum then be dissolved in the irrigation water in small quantities. Secondly, gypsum should be added to the water when irrigating soils with a low infiltration rate, as is the case on compacted fine sandy soils, but no more than 0,5 kg/m^3) should be added.

SOIL MOISTURE

(A)S-Pr.44/1: EVAPOTRANSPIRATION AND WATER-USE STUDIES BY MEANS OF WEIGHING LYSIMETERS: DESIGN AND CONSTRUCTION OF LYSIMETERS. 1973-1977

J.L. Hutson and G.C. Green

The Soil and Irrigation Research Institute has developed an irrigation research area of 4 ha at the Roodeplaat Horticultural Research Institute. The facilities include four lysimeters which were designed to measure and record the water balance of a crop to an accuracy of 0,1 mm water.

Each lysimeter consists of a steel tank, 2 m x 2 m x 1 m deep, supported on a lever system having a mechanical advantage of about 80 to 1. The mass of tank and dry soil can be counter-balanced. The 2 500 kg mass-measuring capacity of the balance cabinets can be used to measure changes in water content which are recorded by means of an electronic load beam installed at the end of the main lever. The load beam output signal can be recorded on a data logger at any desired interval between one minute and two hours. It is necessary to calibrate each load beam periodically but in all cases a change of water content of 1 mm changes the output signal by about 25 μV, thus an accuracy of 0,1 mm of water or 2,5 μV should be attainable.

The tanks were filled with soil obtained from the vicinity of each lysimeter, so that two of them contain soil of the Shorrocks series while the soil in the other two is of the Glendale series. The soil was packd into the tanks in 100 mm layers in the same order and to the same density as was their original condition. The tanks have a drainage system comprising a suction device capable of lowering the potential of the water at the base of the tank to about — 10 kPa.

Underground signal cables have been installed between each lysimeter and the data logger so that various transducers can be used to monitor soil, plant and environmental conditions in and around the lysimeters.

SOIL SURVEYS

H-Ps.239/1: SOIL AS A BASIS FOR AGRICULTURAL DEVELOPMENT IN THE HIGHVELD REGION: THE SOILS OF THE AREA AROUND VENTERSKROON. 1971-1974

G.J. Mulder, S.W.J. Idema, A.J. Basson
J.H. Hattingh and B.C. Geers

A soil survey of the area around Venterskroon was conducted to determine the agricultural potential and to serve as a guide in future planning and possible general consolidation of existing farm units.

The mapped area is situated along the Vaal River in the Potchefstroom district, between 27° 10' and 27°33' E longitude and 26° 45 and 26°59'S latitude and covers an area of 29 123 ha. The surveyed area is easily reached by tarred roads from Potchefstroom to Parys and from Fochville to Parys.

Geologically the area can be divided mainly into two prominent units, *viz.* the Archaean Granite and the Witwatersrand System. These geological formations have a dominant influence on the formation of soils in the area.

Analysis of aerial photographs was made with the aid of a mirror stereoscope and the preliminary soil boundaries were checked in the field (and modified where necessary). The soil boundaries indicated on the aerial photographs were transferred optically to a map (scale 1:25 000) with the aid of a stereo-sketch apparatus. A total of 35 soil series belonging to 18 soil forms were identified and representative profiles described, sampled and analysed.

The distribution of soil series and the area covered by soils on (and by bare rock of) the Witwatersrand System and the Archaen Granite are given in Table 1 and 2 respectively. Only about 19% (5 593 ha) of the area mapped can be regarded as having a high potential for the production of dryland crops. The Shorrocks series, which is the dominant soil series of these high-potential soils, occurs mainly (especially on the Archaen Granite) in a complex association with the low-potential Glenrosa soil form. These soils can best be utilized for the production of fodder crops or pastures.

For the area as a whole, industrial development as well as recreation should be considered as alternative methods of land use. This applies especially to the areas bordering the Vaal River.

TABLE 1 - Area covered by soils on (and by bare rock of) the Witwatersrand System

Soil series	Area	
	ha	%
Mispah	5 524	22,7
Shorrocks	3 113	12,8
Dundee	656	2,7
Lindley	595	2,4
Makatini	479	
Portsmouth	237	1,0
Rensburg	227	0,9
Arniston	144	0,6
Soetmelk	92	0,4
Msinga	88	0,4
Glendale	86	0,4
Bonheim	77	0,3
Sibasa	73	0,3
Bontberg	59	0,2
Waaisand	53	0,2
Other	143	0,6
Total	11 646	47,8
Bare rock	9 052	37,2
Quartzite slope < 20%)	3 489	14,3
Quartzite slope > 20%)	176	0,7
Other	12 717	52,2
Total soil series	11 646	47,8
Total bare rock	12 717	52,2
Total Witwatersrand System	24 363	100,0

TABLE 2 - Area covered by soils on (and by bare rock of) the Archaen Granite

Soil series	Area	
	ha	%
Glenrosa	2 295	48,2
Shorrocks	587	12,3
Balfour	280	5,9
Dundee	177	3,7
Mispah	140	2,9
Rensburg	139	2,9
Lindley	90	1,9
Arniston	89	1,9
Davel	42	0,9
Gelykvlakte	36	0,8
Sibasa	29	0,6
Vaalsand	27	0,6
Sterkspruit	24	0,5
Jozini	23	0,5
Avontuur	22	0,5
Arcadia	19	0,4
Makatini	14	0,3
Grootfontein	10	0,2
Other	15	0,3
Total	4 058	85,3
Bare rock		
Archaean granite slope < 20%	640	13,4
Archaean granite slope > 20%	12	0,3
Epidiorite	50	1,0
	702	14,7
Total soil series	4 058	85,3
Total bare rock	702	14,7
Total Archaean Granite	4 760	100,0

2. SUMMARIES OF THESES*

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PLANT PRODUCTION

Field Crops

GRASSES

MOISTURE ECONOMY

R. Mottram: WATER REQUIREMENTS OF PERENNIAL ITALIAN RYEGRASS
MEASUREMENT OF EVAPOTRANSPIRATION OF *LOLIUM MULTIFLORUM* AND *PASPALUM DILATATUM* AND ITS DEPENDENCE UPON THE CLIMATIC VARIABLES
M.Sc. (Agric.): University of Natal. 1976
Supervisor: Prof. J.M. de Jager

Two economical and sensitive mass-measuring lysimeters for evaluating hourly water usage of crops under experimental conditions were designed, constructed and tested. The cylindrical steel lysimeters of surface area 2,54 m^2 and soil depth 0,4 m rested on commercially-available mechanical balances, each having a resolution of 1:10 000. Both lysimeters were filled with a Hutton-series soil, which is a deep, well-drained, red loamy soil found in the Midlands and Highland-sourveld of Natal. The lysimeters were shown to perform satisfactorily and measurements of water loss accurate to 0,04 mm are possible. Winds exceeding 12 km/h in speed, affected readings and could introduce errors up to 0,04 mm of equivalent evapotranspiration.

Two crops, *Lolium multiflorum* in winter and *Paspalum dilatatum* in summer, were established in and around the lysimeters, the soil in each lysimeter and in the surrounding area having been fertilized to a predetermined optimum level.

Measurements of evapotranspiration (ET) from the lysimeters were compared with each other and with corresponding measurements of open-pan evaporation (EO) from two USWB (United States Weather Bureau) Class A pans, for different periods of time. One of the USWB Class A pans was mounted at the ground level of a commercial mechanical balance. The mean ET/EO ratio from data over the entire growing period was 0,686 for *Lolium multiflorum* and 0,712 for *Paspalum dilatatum*.

Other climatic variables, *viz.* temperature, humidity, incoming solar radiation, wind, saturation deficit and wet-bulb depression were monitored hourly throughout the duration of the experiments. From the data collected, regression equations for estimating ET from the lysimeters, and EO were computed. The majority of these equations predicted ET to an accuracy of within 10 per cent over periods of seven days. Of the climatic variables, radiation, temperature and saturation deficit were the most closely correlated to ET. The most useful equation for estimating ET is that involving dry bulb temperature (TD) alone, *viz*: ET = 0,00664 TD - 0,0273

Because experimental rather than representative lysimeters in a limited field were used, the results are at this stage applicable only to the meteorological station at the University of Natal.

For both the above-mentioned crops the function

$$\text{Yield} = \quad (\text{Stress})$$

was determined. Linear and curvilinear relationships between dry-matter yield and stress were obtained in both cases. From extrapolation of the curves it appears that the first two days of stress have a marked effect with regard to decrease in yield when compared with the longer stress periods of up to 10 days. In this experiment a number of 'stress boxes', filled and fertilized in the same manner as the lysimeters, were used. The crops were harvested when the cover in the 'control' box had reached a stage of approximately 90 per cent light interception, no attempt being made to keep harvesting intervals equal. The mean decrement in yield due to moisture stress appeared to be 3,2 per cent per moisture stress day for *Lolium multiflorum* and 4,6 per cent per moisture stress day for *Paspalum dilatatum*. The critical available soil moisture (ASM) for *Lolium multiflorum* growing on a Hutton-series soil was found to be 50 per cent, while for *Paspalum dilatatum* growing on the same soil the critical ASM was found to be 55-60 per cent.

Finally, the important aspects of a practical irrigation schedule are discussed in detail. Decisions necessary for effective planning and scheduling of irrigation are explained and a practical technique for scheduling of supplementary irrigation using the water-budget technique is illustrated.

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MAIZE

H.W. Kaiser:

MAIZE CROP GROWTH AND DEVELOPMENT RELATED TO SOLAR RADIATION (RESEARCH PROJECT N-Ce.104/2)

Ph.D. (Agric.): University of Natal. 1976
Supervisor: Prof. J.M. de Jager

Interception and reflection of solar radiant energy by maize crops were measured at Cedara near Pietermaritzburg using tube solarimeters. From the measured data the amount of PHAR (Photosynthetically active radiation) that was intercepted was related thus to the L value (leaf area index) of the crop. The value of K_v (the extinction coefficient of PHAR) obtained was found to vary with row spacing, plant population density and cultivar, whereas growth stage, time of day and weather conditions did not appear to effect the K_v value markedly.

On clear days the albedo (R_v) of Cedara's maize crop was of the order of 0,05 to 0,08 at midday. However, at low sun angles in the early and late hours of the day R_v increased to values of the order of 0,2. On overcast days, the diurnal variation was considerably lower.

The rate of photosynthesis in a maize crop was measured using the plastic enclosure technique. The rate of CO_2 uptake was related to the amount of PHAR absorbed by the crop. A rectangular hyperbola was found to describe this relationship well. The photosynthetic response of a crop to population density, plant spacing and temperature at different development stages is discussed.

The seasonal distribution of dry matter in the maize crop was studied using normal growth-analysis techniques. From these data, functions describing the partitioning of dry matter to the various plant organs (e.g. roots, leaves, grain) at different growth stages were developed.

The functions describing the absorption of light by the crop canopy, its photosynthetic rate and the partitioning of photosynthate were incorporated in a computer-simulation model, which was used to estimate the growth of a maize crop from meteoroligical radiant flux density and temperature data. The functioning of the model and its possible use are discussed.

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POTATOES

G.A. Agenbag:
CHEMICAL AND PHYSICAL STIMULATION EFFECTS OF THE AGRONOMIC QUALITIES OF THE POTATO VANDERPLANK (Research project W-Sb.135/2)
M.Sc.: University of Stellenbosch. 1976
Supervisor Dr. V.D. Wassermann

The potato cultivar Vanderplank is known for its very long dormancy period which can vary from two and a half to three months.

Freshly harvested tubers of this cultivar were treated with Rindite, Berelex, ammonium thiocyanate, and a temperature treatment of 25 °C, in order to hasten sprouting. The effect of these treatments on the shortening of the rest period, and on the growth and yield of plants of the treated tubers were compared with plants of untreated tubers.

The experiment was carried out under fully controlled environmental conditions and each treatment was replicated twenty times.

The Rindite treatment gave the most striking results and the plants under this treatment germinated 48 days earlier than the control, while the Berelex treatment shortened the rest period by 32 days. It was only where Rindite was applied to the tubers, however, that the growth was affected. The other treatments had no noteworthy effect on the rest period.

Tuber treatment with Rindite seemed to increase the growth rate of the plants during the early growth stages and this may mean better competition with weeds. Unfortunately it also increased the tempo of plant differentiation to such an extent that maturity was reached at an earlier date than with the control plants. This shorter growth period had an adverse effect on the plant yield.

In general, treatments that successfully broke the dormancy period failed to germinate as uniformly as the control tubers.

It was concluded that although these methods of breaking the rest period may be of value to potato breeders and geneticists they are unlikely to be adopted by commercial growers.

Fruit

APRICOT

DISEASES

A.C. Thomas:
TOXIN PRODUCTION BY *EUTYPA ARMENTIACAE* AND ITS ROLE IN APRICOT DIE-BACK
M.Sc.: University of Stellenbosch. 1977
Supervisor: Mr G. Holz

A dialisable, water-soluble phytotoxic glycopeptide with an approximate molecular mass of 9 600 was extracted from cellophane sheets on potato-dextrose-agar inoculated with *Eutypa armeniacae*. Intact apricot stems treated with the toxin, displayed the major disease symptoms, i.e. cankers, gum formation and vascular browning within 8 days after treatment. An identical serological substance was extracted from naturally infected apricot limbs, thus confirming the presence of this toxin *in vivo*.

Leakage of ^{32}P-labelled compounds from apricot leaf discs and phloem increased after toxin infiltration. The respiration rate of leaf discs, phloem and xilem increased after toxin treatment. The transpiration rate of cut stems in the toxin solution decreased. A decrease in stem conductance was demonstrated by forcing the toxin through the stems. The decrease in stem conductance could not be correlated directly with the molecular mass of the toxin.

GENERAL

DISEASES

H.J. du Plessis:

SEROLOGY, BACTERIOPHAGE AND HOST SPECIFICITY OF *XANTHOMONAS PRUNI* ISOLATES FROM DIFFERENT POME FRUIT TREES.

M.Sc. (Agric.): University of Stellenbosch. 1977
Supervisor: Prof. M.A. Loos

Serological relationships, bacteriophage and host specificity of *Xanthomonas pruni* isolates from peach (*Prunus persica* Zieb & Zucc.), plum (*Prunus domestica* Linn.) and apricot (*Prunus armeriaca* Linn.) trees were investigated. This was to determine whether infection of different *Prunus* species in South Africa was caused by similar or different strains of *X. pruni.* If the latter probability could be proved, this would explain the field observation that one *Prunus* species in a specific area was infected by *X. pruni*, while other *Prunus* species growing in adjacent orchards were unaffected.

Serological studies with the Wassermann-tube agglutination test and Ouchterlony gel-diffusion test showed that with the exception of one New Zealand isolate, no differences occurred within the somatic antigens of the *X. pruni* isolates. This New Zealand isolate differed quantitatively from the other nine isolates by exhibiting the release of diffusible antigens at a lower concentration.

Three bacteriophages encoded FII, FIV and FV, were isolated from the surface of soil beneath a plum tree infected with *X. pruni.* Using a typing test and the efficiency (titration endpoint) of the phages on cultures of the isolates, no significant differences among the other eight isolates were found, with the exception of the two New Zealand isolates. One of the New Zealand isolates was immune against infection by the phages and the other was lysed with decreasing efficiency by the three phages. Non-induced and ultra-violet-induced cultures of the latter isolates released temperate phages. Plaque morphology of the phages on cultures of the isolates in double agar-layer-plates, could possibly be utilised to differentiate all nine sensitive isolates from each other. However, the plaque morphology of a specific phage-host combination, differed with each replication.

Cross-infection studies in a climatic chamber involving five South African *X. pruni* isolates on the three *Prunus* species from which they were isolated, proved that the isolates were not selective in their ability to infect the different *Prunus* species.

Isolates of *X. pruni* from South Africa, Argentine and the USA appeared, to be the same strain. This strain, which was isolated from peach, plum and apricot trees, was probably disseminated together with these *Prunus* species, and perhaps other hosts, to different parts of the world. The difference between the two New Zealand isolates and the remaining eight isolates and which was demonstrated by the bacteriophage techniques, could be the result of lysogeny. Thus, the hypothesis which formulated the existence of different strains of *X. pruni* that differed in their specificity for the various *Prunus* species, could not be confirmed.

Pastures

CULTIVATED PASTURES

FERTILIZERS

N.G.E. Hackland:

A STUDY OF THE NUTRIENT REQUIREMENTS OF *TRIFOLIUM AFRICANUM* VAR. *GLABELLUM* SER. ON FARMINGHAM AND LONGLANDS SOILS.

M.Sc. (Agric.): University of Natal. 1977
Supervisor: Prof. P. de V. Booysen

This study was initiated when it was found that exotic legumes were generally unsuitable for reinforcing the natural pastures of South Africa and that indigenous legumes seemed better adapted. *Trifolium africanum* var. *glabellum* was one of the first of the indigenous legumes to show promise. However, the soil fertility requirements of this species were unknown.

Two soil types, Farningham and Longlands series, which are both commonly found in the Natal Midlands were included in the trials.

A preliminary trial on six minor plant nutrients and two major plant nutrients was conducted in order that any mineral deficiencies in the soils could be corrected in the subsequent trials. There appeared to be no significant deficiences of any of the eight nutrients applied to the Farmingham soil. The plants in the Longlands soil failed to establish.

As a result of this difference in the germination and establishment on the two soils a germination trial involving five scarification treatments (0, 10, 20, 30 and 40 minutes in 98% H_2SO_4) was conducted.

Scarification for between 20 and 30 minutes improved germination of the seed on filter paper and in Farningham soil. There was a peculiar depression in the germination in Longlands soil at the 20-minute scarification treatment. This phenomenon was not investigated.

The first trial involving the major plant nutritients was initiated in order to compare the two soil types and the response of *T. africanum* to P, K and lime. However, the trial on the Longlands soil again failed to establish and was finally abandoned.

The results from the Farningham soil showed that exchangeable Al was the most important yield-limiting factor. There was little response to lime applied beyond that necessary to eliminate exchangeable Al. The application of P beyond 180 ppm tended to decrease the yield of a number of variates (total mass, nodule rating, stem length and number of leaves). Potassium treatments did not affect the yield of *T. africanum*.

A subsidiary trial showed that by adding about 10% by mass of vermiculite to the Longlands soil, successful establishment of *T. africanum* could be achieved. Therefore, this soil conditioner was used in the final trial so that the potential of the two soils could be compared. Vegetative establishment of *T. africanum* was also used since it gave a far quicker and more reliable method of establishment than did seed. *Trifolium repens* cv. Ladino was also included in this trial in order that a comparison of the production of *T. africanum* could be made against that of Ladino white clover. Three levels of P, K and lime were applied to Farningham and Longlands soils (8% by mass of vermiculite was added to the latter soil).

The results showed that *T. africanum* was less sensitive to different soil types and was also very much more tolerant of high levels of exchangeable Al than Ladino clover. However, both species responded markedly (between two and fivefold increase) to application of the lime necessary to eliminate exchangeable Al. White clover responded more to applied-P than *T. africanum*, however the P content of the latter species was more dependent on the amount lime applied than to the amount of P applied to the soil. The Ca content of *T. africanum* was higher than that of white clover. The yields of both species were similar but the growth rate of Ladino clover and its leaf-to-stem ratio were far hiigher than those of *T. africanum.*

Further studies on *Trifolium africanum* are necessary, particularly on aspects such as animal acceptability, nutritive value, bloat potential and establishment techniques.

ANIMAL PRODUCTION

Farm Animals

CATTLE

BEEF PRODUCTION

D.E. CRONJé: THE INFLUENCE OF BREED, SEX AND AGE OF CATTLE ON CERTAIN CHARACTERISTICS OF MEAT QUALITY, WITH PARTICULAR REFERENCE TO THE INFLUENCE OF COLLAGEN ON MEAT-TOUGHNESS
(Research project (A)VS-Pr.76/6)*.
M. (Agric.): University of Stellenbosh. 1976
Supervisor: Prof. J.L. de Wit

Afrikaner and Friesian bulls and steers were compared up to the age of 20 months in respect of certain meat-quality parameters in five muscles of the carcass, *viz. Musculus longissimus thoracis* and *M.*

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*See also Report Summary on page

semimembranosus, M. semitendinosus, M. pectoralis profundus and *M. triceps brachii caput lateralis*. The quality characteristics investigated were meat-toughness, cooking-loss and muscle colour. Certain carcass and sexual development characteristics that could be related to meat-quality characteristics were also examined.

It was found that the meat in the forequarter muscles of Friesians was tougher than in the case of Afrikaners, but no difference in toughness could be found between the breeds in the *M. longissimus thoracis* and the hindquarter muscles. The meat of Afrikaners had a larger cooking-loss and also contained more myoglobin than the meat of Friesians. Although Friesians gained more rapidly in body-mass than Afrikaners, they also had a higher fat content in the prime rib joint. Friesian bulls reached sexual maturity earlier than Afrikaner bulls.

No differences could be found between the meat of bulls and steers for the three meat-quality characteristics examined. Bulls, however, grew faster than steers and contained less fat in the prime rib joint.

The meat of all animals that were examined became tougher as the animals grew older, had a lower cooking-loss and contained more myoglobin. The percentage of fat in the meat also increased resulting in a decline in muscle percentage.

In addition it was found that the total collagen content of muscles could not serve as a reliable single criterion of the toughness of meat but that it was preferable to use the solubility of the collagen for this purpose. Changes in collagen solubility did not always directly relate to changes in toughness. The method of cooking and therefore of heating the collagen used in this investigation had an important bearing on this last-named result.

H.J. Meaker:

THE IMPORTANCE OF AGE AT FIRST CALVING, AND THE RELATIONSHIP BETWEEN BODY MASS AND FERTILITY AND FEEDING SYSTEMS ON PRODUCTION IN THE BEEF FEMALE (Research projects N-Ce 115/6,9,10 & 16)

Ph.D. (Agric.): University of Natal. 1978
Supervisor: Prof. A.W. Lishman

Two experiments were conducted to investigate the effects of supplementary feeding of locally produced feeds during winter on the reproductive performance of the beef cow. The experiments continued for one and four years respectively. In a third experiment, which continued for three years, the effects of supplementation of protein and/or energy to lactating cows during a 100-day period post-calving, on the reproductive performance of the beef cow were studied. The following were the main conclusions:

A dramatic increase in reproductive performance was recorded when cows were supplemented during the winter with maize silage and/or *E. curvula* hay. The reconception rates of cows overwintered or either silage *ad lib., E. curvula* hay *ad lib.*, silage and hay *ad lib.* or rested winter veld were 87,5%, 68,2%, 79,2% and 25,0% respectively (Experiment 1).

In the second experiment it was concluded that all three systems (silage, hay and silage-hay) were equally effective in overwintering beef cows and maintaining reproductive performance. Calving percentage - estimated average 86%; birth mass of calves - range 32 to 33 kg; weaning mass of calves - range 199,7 to 213,8 kg and intercalving period - range 378,8 to 375,5 days were recorded for the three systems.

The average total winter feed costs per cow for the silage, hay and silage-hay systems were R33,92, R32,19 and R33,17, respectively, while the "profit" margin above feed costs for the three systems was R38,32, R36,51 and R40,38 per cow. Winter feed cost (roughages only) represented approximately 39% of the total income.

Neither of the three systems supplied a balanced diet to the cows. During the pre-calving period all three systems supplied amounts of CP and TDN which greatly exceeded the requirements. During the post-partum period the three systems more or less satisfied the requirements of the cows.

In the third experiment the average re-calving percentage for the cows receiving energy-rich, natural protein and non-protein nitrogen supplements and for the Control cows, was 96,0%, 85,8%, 85,5% and 73,1%respectively.

The average CP content of clipped grass samples at the Dundee Research Station for the summer, autumn, winter and spring periods was 5,88; 4,20; 3,80 and 5,67%, respectively. The Ca and P content showed no great variation over the four seasons and averaged 0,17 and 0,11% respectively.

Based on assumptions concerning the average intake of a lactating beef cow and the chemical composition of the grass sward, it was estimated that the veld supplied 90; 65; and 42% of the TDN, CP, Ca and P requirements (NRC, 1976) of the lactating beef cow.

In a 2x3 factorial experiment the effects of two pre-calving and three post-calving levels of nutrition (calculated on a TDN basis) were studied on the productive and reproductive performance of adult cows. The following were the main conclusions:

The reproductive performance of the cows was not affected when they lost 22 kg (4,4%) during the last 93 to 135 days before calving, provided they were well fed after calving.

Post-calving nutritional levels influenced the interval to first post-partum oestrus while nutritional levels *pre partum* had no effect. The intervals to first post-partum oestrus for the cows in the High, Medium and Low groups were 64,6; 73,9; and 72,3 days, respectively. The incidence of first post-partum oestrus, within the first 95 days after calving, for the cows in the High, Medium and Low groups was 78,4; 36,4 and 54,6% respectively.

The average daily milk yield (daily milk yields recorded at one, three and at five months) for the cows in the High, Medium and Low groups was 4,85; 4,28 and 4,01 kg per cow, respectively.

The effects of age at first calving (two vs three years of age) on the productive and reproductive performance of beef cows were studied over a period of six years. The following observations were made:

The average conception rate over the productive life of five-year-old cows that calved for the first time at either two or three years of age was 81,4 and 62,0%, respectively. The average conception rate of yearlings was 61,3%.

The average percentage dystocia recorded with the cows calving for the first time at two or three years of age was 8,1% and 3,2%. Weaning mass increased concurrently with age of the cow. The 205-day corrected weaning masses for cows that were two, three and four years of age were 129,5; 147,0; and 155,1 kg, respectively. The disappointingly low weaning mass of the calves born to two-year-old cows (129,5 kg) led to the introduction of a creep ration which increased the weaning mass by 25,1 kg.

Cows calving for the first time as two-year-olds produced 0,7 more calves than those calving for the first time as three-year-olds when calculations were based on a productive life of five years.

The average mass and age at puberty for Afrikaner cross Sussex heifers were 236 kg and 342 days.

Seven skeletal measurements, *viz.* heart girth, body mass, height at withers, height at rump, depth of chest, length of body, width of thurls and width of hips were recorded at yearly intervals until five years of age, for cows that had calved for the first time at two or three years of age. Only body mass at two years and height of withers at three years, were significantly affected by early calving. In both these cases the differences had disappeared by the following year. None of the remaining measurements was affected by early calving, indicating that two-year-old calving had no depressing effect on the growth of the cow until five years of age.

A significant ($P<0,01$ curvilinear function was fitted to the relationship between circumference of heart girth (X) and body mass (Y) for 117 cows ranging in age from yearlings to five-year-olds and irrespective of age at first calving.

$Y = 4715,2 + 4,0X - 270,1X^{0,5}$

Age at first calving did not affect the mean milk production of three and four-year-old cows. However, age of the cow significantly affected milk production. The average total milk production for two, three and four-year-old cows at one, three and five months, was 8,49; 11,63 and 15,20 kg, respectively.

Records of body mass and reproductive performance of 920 cows, ranging in age from yearlings to adults (five years and older) were examined. The data were obtained over a six-year period and included: Body mass at the start and at the end of the breeding season, percentage gain in mass over the mating season, body mass at the start of the winter and peak autumn body mass.

Various relationships were established for the different age groups, between body mass (X) and conception (Y), indicating a concurrent linear and/or curvilinear increase in conception rate with body mass at the start or at the end of the mating season.

The mean peak autumn mass for 179 adult lactating cows was 469,8 ± 6,8 kg. For conception rates of 50, 75 and 90%, the changes in body mass from the autumn peak to the start of the mating season were -20,6; -8,7 and +5,9%, respectively.

No relationship could be determined between conception rate and body mass at the start of the winter, end of the winter, percentage gain or loss over the winter and percentage gain over the breeding season.

PHYSIOLOGY

N.H. Casey:

THE UREA DILUTION TECHNIQUE FOR ESTIMATING THE BODY COMPOSITIONS OF YOUNG SLAUGHTER CATTLE *IN VIVO*. (Research project OK-Do.66/5)

M.Sc. (Agric.): University of Natal. 1976
Supervisor: Prof. W.J. Stielau

The aim of the investigations was to establish the relationships between urea spaces measured at various times after urea infusion and the composition of the right-side 8-9-10th prime ribs, as well as to derive from the results an acceptable time at which to measure urea spaces after infusion.

In the preliminary investigation the disappearance of infused urea from the blood stream was observed in 25 calves ranging in mass from 86 to 135 kg. A physiological saline solution containing 20% urea was accurately infused into the jugular vein through a catheter in an amount calculated to provide 130 mg urea per kilogram fasted body-mass (FBM). The concentration of plasma urea nitrogen was determined in blood samples taken after the urea infusion. Urea spaces were calculated and expressed as percentages of the fasted body masses.

These measurements, plotted on a log basis against time, presented a curve illustrating the decrease in plasma urea nitrogen concentration over the sampling period. This figure showed a rapid drop in blood

TABLE 1 - Equations for predicting prime rib composition from urea space measurements taken at T_{12} and T_{15}.

Prime rib component	Sampling time	Prediction equation	
% Moisture	T_{12}	Y = 6,8453 + 0,9666 X (r	= 0,8877)
		Estimate of variance (b)	= 0,0503
		S.E. (b)	= 0,0709
		t (D.F. n-2 = 50)	=13,633**
	T_{12}	Y = 11,513 + 0,8427 X (r	= 0,8514)
		Estimate of variance (b)	= 0,00539
		S.E. (b)	= 0,07343
		t (D.F. n-2 = 50)	= 11,477**
% Fat	T_{12}	Y = 86,6919 - 1,1784 X (r	= -0,8973)
		Estimate of variance (b)	= 0,0067
		S.E. (b)	= 0,082
		t (D.F. n-2 = 50)	= 14,37**
	T_{15}	Y = 81,055 - 1,0282 X (r	= -0,0074)
		S.E. (b)	= 0,0858
		t (D.F. n-2 = 50)	= 11,986**
% Protein	T_{12}	Y = 0,1111 + 0,1771 (r	= 0,7318)
		Estimate of variance (b)	= 0,0005
		S.E. (b)	= 0,0233
		t (D.F. n-2 = 50)	= 75030
	T_{15}	Y = 6,8948 + 0,1556 (r	= 0,7072)
		Estimate of variance (b)	= 0,000382
		S.E. (b)	= 0,01954
		t (D.F, n-2 = 50)	= 7,9657**
% Lean	T_{12}	Y = 14,7602 + 1,1543 X (r	= 0,8937)
		Estimate of variance (b)	= 0,00671
		S.E. (b)	= 0,08194
		t (D.F. n-2 = 50)	= 14,088**
	T_{15}	Y = 20,2357 + 1,008 x (r	= 0,8586)
		Estimate of variance (b)	= 0,00725
		S.E. (b)	= 0,0851
		t (D.F. n-2 = 50)	= 11,8403**

urea over the first half-hour of the sampling period. This presumably signified that the infused urea had diffused to all the available body-fluid spaces within half-an-hour of infusion.

In the subsequent investigation 54 steers about 18 months of age with a live mass between 284 and 487 kg, were used to establish both an optimum time for urea space determination and the relationship between urea space and carcass composition. Urea space measurements were calculated from the plasma urea concentrations of blood samples taken at 6, 9, 12, 15 and 18 minutes post infusion and again expressed as percentages of FBM. No significant differences were observed between the coefficients of variation for the urea spaces measured at the various times. The lowest coefficients of variations occurred at T_{12} and the highest at T_6.

All the urea-space values for each sampling time were correlated with the percentages of moisture, protein, fat and lean in the deboned prime ribs taken from the right half of the carcass. Although these correlations were all highly significant ($P<0{,}001$), the highest correlation coefficients were observed with urea-space measurements taken at T_{12} and T_{15}. It was concluded, therefore, that T_{12} and T_{15} are acceptable times for measuring urea space as a predictor of the composition of the prime rib cut. The prediction equations using urea-space measurements taken at T_{12} and T_{15} were established and presented in Table 1. The standard errors, based on deviations from regression, for the relationship between urea space at T_{12} and the percentages of moisture, protein, fat and lean were 2,848; 0,937; 2,559 and 3,292 respectively.

The urea dilution technique, as reported in this investigation thus offers a means of assessing the body composition of slaughter steers in the mass range of 284 to 487 kg. The method may also be employed to monitor the growth and development of beef cattle.

PIGS

NUTRITION

L.R.A. Horsten:

EVALUATION OF TRITICALE AS A FEED GRAIN FOR GROWING PIGS. (Research project W.Eb.101/3)

M.Sc. (Agric.): University of Stellenbosch. 1977
Supervisor: Dr. W.A. Vosloo

The following nutritional value aspects of triticale were investigated in several series of experimental trials with pigs and chickens:

(a) The protein quality of triticale determined in digestibility trials with pigs and NPU determinations with chickens.
(b) The energy value of triticale.
(c) The effect of the progressive substitution of maize by triticale in protein and amino-acid balanced diets for growing pigs, on the production performance of the pigs.
(d) The influence of triticale on body composition of live growing pigs as measured by the TOH space method.

While no significant differences could be observed between the protein digestibility and nitrogen retention of the pigs on the different treatments, highly significant ($P<0{,}01$) correlations were found between the crude-protein content of the diets and its protein digestibility ($r = 0{,}91$ and $0{,}90$ for triticale A & B respectively). However, the correlations between the crude-protein content of the diets and the nitrogen retention by the pigs proved not to be significant. Biological values of the protein in the diets ranged from 25,2 to 43,6 per cent but no significant trend over the replacement range could be observed. Though not significant the digestible and metabolizable energy of the diets tended to decrease with increasing levels of triticale.

Pigs were individually fed *ad lib* from 18,5 to 45,0 kg live mass during the growth trial. No significant differences between treatments could be observed for average daily gain, feed-conversion ratio or the ME (MJ) required per kg live mass gain. Certain carcass measurements were taken after slaughter.

Although no significant differences over the range of treatments could be found, the C + K fat thickness measurements of the control groups were generally thinner than those of the groups receiving triticale. The inclusion of various levels of triticale did not influence the daily intake of the diets by the pigs. Thus provided triticale is ergot-free its inclusion in pig diets is not expected to affect the palatability or acceptability of such diets for pigs.

The use of the TOH space technique as a direct predictor of the total body moisture, resulted in a 20 per cent overestimation. This is ascribed to the loss of labelled hydrogen in the ingesta, body tissues and urine during the equilibration period. However, the TOH space method still proved to be highly accurate as a predictor of total body water ($r = 0{,}96$).

Net protein utilization (NPU) was determined in trials with chickens to establish the limiting amino acids in triticale. Large variations in the NPU values were obtained. Two possible reasons for this variation are discussed, namely: The high gluten content of the triticale which hindered the intake of the diet by adhering to the chickens' beaks, and the possible unsuitability of the specific regression equation applied for the prediction of the nitrogen content of the chicks. A 10% difference between the predicted and determined (actual) values were obtained. These results suggest that lysine might be the first limiting amino acid in triticale but that an interaction also exists between lysine and leucine.

Generally it can be concluded that triticale can replace maize in the diets of growing pigs without adversely affecting the production performance of the pigs, provided that the amino acids in such diets are balanced according to the specific requirements of the pigs.

G.N. van Wyk:

EVALUATION OF THE EFFICIENCY OF CERTAIN NUTRITIONAL STANDARDS FOR GROWING PIGS FED ON DIETS THAT HAVE BEEN FORMULATED WITH THE AID OF LINEAR PROGRAMMING TECHNIQUES

(Research project W-Eb.101/2)
Ph.D. (Agric.) University of Stellenbosch. 1977
Supervisor: Dr W.A. Vosloo

The object of this study was to establish minimum and maximum crude protein and crude fibre requirements in diets for growing pigs as generally applied in South Africa. For the purpose of formulating the diets with various combinations of the two feed substances (crude protein and crude fibre) minimum-cost diets were determined by means of the linear programming technique. The effects of crude protein and crude fibre separately and in combination in the diets on baconers were quantified in terms of growth rate, feed-conversion efficiency and carcass grading. In addition, the financial implications of the physical results were analysed.

Regression equations were formulated to be used to predict average daily mass gain as a growth criterion for both feeding periods. Because of the importance of lysine in crude-protein quality and the negative relationship between crude fibre and energy content in the diet, the multiple regression equations were calculated by means of crude protein and crude fibre intakes as well as lysine and metabolizable energy intakes, respectively.

In order to determine the economic implications of the variation of crude protein and crude fibre in the diet of growing pigs, two situations which occur generally in practice in pig production, were taken as points of departure in the planning of a production unit for baconers. In the case of the first situation it was assumed that a producer had an annual quota for the marketing of 2 000 baconers and that a unit had to be planned with due regard to the influence of diet treatment (growth rate) on the housing for the baconers.

In the case of the second situation it was assumed that housing already existed (so that there was a constant floor area). The effect of a variation in growth rate (a variation as a result of a difference in diet composition) on the number of pigs which can be produced on this constant floor area was then established. For both situations the economic implications of growth rate for a baconer unit were determined and expressed in terms of the gross margins. Gross margin was taken as being carcass income minus the cost of feeding and buildings. The cost of buildings is made up of interest and the depreciation and maintenance of buildings.

An increase in growth rate results in a reduction in the feeding cost per pig, which is the most important factor affecting gross margin.

The gross margin rose when the crude-protein level of the air-dried diet increased from 11,9 to 15,9%, but a further increase in crude protein to 19,6% did not have a significant effect on the gross margin.

A decrease in the crude-fibre content from 9,7 to 4,1% in the air-dried diet resulted in an increase in the gross margin. A further decrease in the crude-fibre level to 3,2% had no effect on the gross margin.

In the case of a situation where 2 000 baconers are marketed per year, the difference between the treatment with the highest (15,9% crude protein and 4,1% crude fibre) and lowest (13,9% crude protein and 9,7% crude fibre) gross margin was R7 639. Where the floor area remained constant, while the number of pigs marketed per year varied, the difference between the highest and lowest gross margin was R19 683.

SHEEP

BREEDING

G.J. Erasmus:

THE BREED STRUCTURE OF THE SOUTH AFRICAN MERINO

(Research project (A)VS-Pr.89/2)
M.Sc. (Agric.): University of the Orange Free State
Supervisor: Dr A.O. de Lange

Analysis of flock records kept by the Merino Stud Breeders' Association from 1938 to 1974 shows a sharp increase, particularly as regards the smaller studs, in both the number of registered breeders and the total number of stud ewes to 1967, with an equally sharp decline between 1970 to 1973. It was concluded that smaller studs have a smaller chance of survival. Though the average number of stud ewes per breeder is low (stabilised at approximately 230 since 1966) registered breeders each possess an average of 2 000 commercial ewes and it is recommended that these ewes be used to increase the size of stud flocks.

The 773 active studs (1974) are classified into parent, daughter, general and isolated studs and the number of stud rams sold by each group is discussed in detail. Registered breeders supply only 54% of the total number of Merino rams required in the Republic.

Implications of the present breed structure, — which tends towards a two-tier structure rather than the classical three-tier pyramid —, on the strategy of extension efforts regarding the Performance Testing Scheme, are discussed and it is concluded that the fleece analysis service should not be restricted to certain "elite" flocks. The necessity for inter-flock comparison of actual genetic merit, and the implications of the fact that Merino stud flocks are largely centered in the Eastern Karoo are also discussed.

DISEASES - FUNGUS

Cecilia Roux:

STUDIES OF TOXIGENIC FUNGI OF STOCK FEEDS: FACIAL ECZEMA IN SHEEP.

(Research project (A)PS.Pr.35/3)
M.Sc. (Botany): Rand Afrikaans University. 1977
Supervisor: Dr K.T. van Warmelo

The occurrence and distribution, morphology and some aspects of the physiology of *Pithomyces chartarum* (Berk. & Curt.) M.B. Ellis in South Africa were studied as this fungus is associated with photosensitivity in stock animals in South Africa.

Culture characters of eight isolates of *P. chartarum*, obtained from samples of plant material from which it could be obtained as a saprophyte and possibly as a pathogen, were studied on five different media and at different temperatures with and without lighting. The morphological characters of conidia were studied with both light and scanning electron microscopy.

P. chartarum was found to be present throughout South Africa as a saprophyte and possibly as a pathogen. Conidia of the fungus were found in the air over the Karoo as well as on *Tribulus terrestris* plants where photosensitivity of sheep in South West Africa and in the Karoo had occurred. It was also isolated from several other localities in association with photesensitivity of animals but only a quarter of the isolates tested were toxigenic. Isolates which produced sporidesmin under standard culture conditions on semi-synthetic broth at 20 °C and intermittent near-ultraviolet illumination, were only isolated from samples of plant material which were taken from camps where photosensitivity of animals in the veld had occurred.

The eight isolates of which the morphology and physiology were studied, showed that the fungus is very variable; the factors which contributed to this variability were lighting, temperature, culture-medium and the properties of the isolates mentioned.

It was proved that the culture conditions under which different isolates of *P. chartarum* were grown, could influence morphological characters like conidium size and septation, which facts were of taxonomic importance.

Under specific culture conditions the four toxigenic and four non-toxigenic isolates chosen, were all capable of producing sporidesmin after 21 days but the sporidesmin produced was only related to the sporulation of the isolate in the case of toxigenic isolates. Seeing that each of the isolates studied was able to produce sporidesmin it is concluded that there are apparently no really non-toxigenic strains of *P. chartarum*.

REPRODUCTION

Erna Dierkse: **CHANGE IN SERUM PROGESTERONE AND LUTEINIZING HORMONE LEVELS AFTER SYNCHRONIZATION OF OESTRUS IN SHEEP.**
M.Sc. (Agric.): University of Stellenbosch. 1978
Supervisor: Dr J.M. van der Westhuysen

The effect of the presence of the ram, and oestrus synchronization using progesterone, on the occurrence of oestrus and the concentration of serum progesterone and luteinizing hormone (LH) was investigated in a 2^2 factorial experiment using Merino ewes.

The continuous presence of the ram had a highly significant ($P<0,005$) effect on the length of the oestrus period in both the progesterone-treated and control ewes. The length of oestrus was reduced in that the end of the oestrus period occurred sooner in treated ewes.

The maximum concentration and the total peak volume of serum LH were greater in ewes continuously exposed to the ram than in ewes separated from rams. The differences, however, were not statistically significant.

Progesterone treatment resulted in lower LH peak values and total peak volumes. The values for treated ewes with silent oestrus were lower than for treated ewes that showed oestrus. These differences were, however, statistically insignificant.

Both before and after the end of progesterone treatment, serum progesterone levels were significantly ($P<0,05$) higher in treated ewes that did not show oestrus than in those that did. Thus it would appear that the exogenous progesterone treatment of ewes with a high endogenous progesterone level inhibited prostaglandin $-F_{2\alpha}$ with a consequent retention of *corpus luteum*.

There were indications ($P<0,10$) of an increased serum progesterone level six hours prior to the onset of oestrus in progesterone-treated ewes and 12 to 18 hours later in the control group. The purpose and cause of this increased secretion could not be established from the experimental results.

Quality control tests for progesterone assays indicated that such tests should become standard practice in the radio-immuno-assay laboratory.

C.A. van der Merwe: **GENETIC AND NON-GENETIC FACTORS AFFECTING PRODUCTION AND REPRODUCTION OF THE ELSENBURG DORMER FLOCK** (Research project W-Eb.2)
Ph.D. (Agric.): University of Stellenbosch. 1976
Supervisor: Dr L.P. Vosloo

A historical survey of the development of the Dormer breed and a brief description of the record-keeping, selection and management of the Elsenburg Dormer flock are given. Data in respect of approximately 5 400 individuals born into this flock during the period 1941 to 1971 were analysed. Part of this study is based on random samples of approximately 120 male and female progeny born in 1968 and 1969, which results will be referred to as those of the ”small sample”.

A highly significant $p<0,01$) proportion of the variation in birth mass, mass increase from 0 to 100 days and mass at the age of 100 days was accounted for in terms of the non-genetic factors, namely years, age of mother, sex of the lamb and birth status of the lamb. The previous reproduction performance of the mother, however, did not have a significant effect on these production characteristics. As far as the conformation score at the age of 100 days is concerned, it was found that years, age of mother, previous reproduction performance of the mother and birth status were highly significant ($p<0,01$) sources of variation. The sex of the lamb had no effect on the conformation score.

The birth status of the lamb had a highly significant ($p<0,01$) effect on mass increase from 0 to 21 days, 21 to 42 days and 42 to 70 days of age. The sex of the lamb had a significant ($p<0,01$) effect on the performance only after the age of 42 days. (Small sample).

The age of the mother ($p<0,05$), sex ($p<0,01$) and birth status ($p<0,01$) had a significant effect on lamb mortality.

An investigation was made of the polymorphism in respect of haemoglobin, transferrin, plasma aryl esterase and X-factor types for a random selection of the flock. The phenotypical and gene frequencies determined in the present study are consistent with values previously reported for the same flock by other researchers. (Small sample). No appreciable connection was found between blood types and pre-weaning production characteristics. (Small sample).

The degrees of heritability of (i) birth mass, (ii) mass increase from birth to the age of 100 days, (iii) mass at the age of 100 days and (iv) conformation score were estimated by means of halfsib analysis of variance. The values obtained for the characteristics in the above-mentioned order are: (i) 0,078± 0,030 and 0,269± 0,075, (ii) 0,120± 0,032, (iii) 0,120± 0,031 and (iv) 0,111± 0,050.

The heritability of still or live-birth was estimated at 0,05185± 0,0064 and the heritability of survival after birth (dead before the age of 21 days as against surviving after the age of 21 days) was estimated at 0,10314± 0,0123. It was found that lambs which survived to the age of 100 days had a significantly ($p<0,01$) greater birth mass than those which died before reaching this age.

Birth mass was to a significant extent ($p<0,01$) positively correlated with mass for age at the age of 21, 42, 70 and 100 days. There was also a significantly positive correlation between birth mass and mass increase from the age of 0 to 21 days, 21 to 42 days and 0 to 100 days, as well as between birth mass and conformation score as awarded at the age of 100 days. Phenotypically, mass for age at the age of 21, 42, 70 and 100 days was highly significantly ($p<0,01$) correlated in all combinations. The mass increase between the periods 0 to 21 days, 21 to 42 days, 42 to 70 days and 70 to 100 days of age had a low phenotypical correlation in all combinations. (Small sample).

The phenotypical correlation between mass at the age of 100 days and mass increase from 0 to 100 days of age was estimated at 0,9918, and the phenotypical correlation between mass at the age of 100 days and conformation score was estimated at 0,6946.

Genetic correlations were estimated in various combinations for the following characteristics: birth mass (X_1), mass increase from 0 to 100 days at age (X_2), mass at 100 days of age (X_3), and conformation score at 100 days of age (X_4). The correlations were as follows: $X_1X_2 = 0,291 \pm 0,051$; $X_1X_3 = 0,440 \pm 0,050$; $X_1X_4 = 0,794 \pm 0,175$; $X_2X_3 = 0,99 \pm 0,003$; $X_2X_4 = 0,262 \pm 0,302$; and $X_3X_4 = 0,409 \pm 0,259$.

The phenotypical relationship between pre-weaning production characteristics and quantitative blood components was investigated. Indications were that the potassium content of the blood plasma could possibly serve as an indictor of mass increase and mass for age. (Small sample).

In calculating the average selection differential obtained in the long term, it was found that considerable selection pressure had been exerted for mass increase from 0 to 100 days of age and conformation score was awarded at 100 days of age. Approximately the same weight had been assigned to each of the above-mentioned characteristics in the application of selection.

Response was determined by estimating the linear regression of a particular characteristic on the father's age. The data were corrected for the effect of years, age of mother, birth status, sex and inbreeding coefficient.

The estimated average annual responses for birth mass, mass increase (0-100 days), mass at 100 days of age and conformation score are, in the same order, +0,038 kg, -0,001 kg, -0,025 kg and +0,052 points. No response was significant.

The average generation interval was calculated at 3,37 years.

It was assumed that only one characteristic, namely mass at 110 days of age of conformation score, had been selected for. When obtained response is compared with estimated response, it would seem that if this characteristic had been selected for the estimated degree of heritability for mass at 100 days of age (and mass increase as well) (0-100) was overestimated. It is possible, however, that conformation score was all that was directly selected for.

The production performance directly after weaning as determined with individual feeding was investigated. This investigation was carried out at both a high and a low feeding level. (Small sample).

The average gross efficiencies of food utilization for two sets of experimental material were 5,997 and 6,962 at the high feeding level while the partial efficiencies at the same feeding level were 2,222 and 3,249, respectively. (Small sample).

The gross efficiency and partial efficiency at the low feeding level were determined for one set of experimental material. The average values for the said characteristics were calculated at 11,432, respectively. (Small sample).

The birth status of the lamb had no significant effect on any production characteristics directly after weaning. (Small sample).

Repeatability was very low for all post-weaning characteristics, with the exception of daily feed intake, in respect of which values of 0,509 and 0,589, respectively, at low and high feeding levels were estimated. (Small sample).

There was no indication of genotype feeding-level interaction. (Small sample).

No usable correlation between post-weaning production performance and blood types or quantitative blood components was found. (Small sample).

Estimates were made of the phenotypical correlations between the various post-weaning production characteristics. High correlations were found between, *inter alia*, efficiency of food utilization and mass increase. (Small sample).

It would appear as though a degree of heritability of approximately 10-20% can be expected as far as efficiency of food utilization is concerned. (Small sample).

Two-tooth body mass was significantly ($p<0{,}01$) affected by year of birth, age of mother and birth status.

Both the linear and the curvilinear regressions of two-tooth body mass on the basis of year were calculated, but they were not significant.

The phenotypical correlations between two-tooth body mass (X_1) and birth mass (X_2), mass increase (0-100 days) (X_3) and mass at 100 days (X_4) were calculated as being $X_1X_2 = 0{,}329$; $X_1X_3 = 0{,}496$; and $X_1X_4 = 0{,}538$. All these values are significant.

The genetic correlations between two-tooth body mass (X_1) and birth mass (X_2), mass increase (0-100 days) (X_3) and mass at 100 days (X_4) were calculated as being $X_1X_2 = 0{,}612 \pm 0{,}231$; $X_1X_3 = 0{,}622 \pm 0{,}196$; and $X_1X_4 = 0{,}0706 \pm 0{,}173$.

The degree of heritability of two-tooth body mass was estimated at 0,477 ± 0,123.

It was calculated that indirect selection for 100-day mass with two-tooth body mass as selection criterion would be 36% more effective than direct selection.

A regression of two-tooth body mass on age of father was calculated after the date had been corrected for years, age of mother, birth status and inbreeding coefficient. The regression coefficient was significant ($p<0{,}05$ and pointed to an average annual response of 1,092 kg.

It was found that pregnancy and lactation in a particular season had a significant effect on the ensuing mating mass; this effect was observed in virtually all age groups.

The repeatability of adult body mass was calculated at 0,42. The ewes on which the intraclass correlation was calculated were from groups aged 1-1/2, 2-1/2, 3-1/2, 4-1/2, 5-1/2 and 6-1/2 years respectively.

A significant curvilinear regression was calculated for body mass on age. The maximum body mass for ewes is attained at the age of 3-1/2 years.

It was found that the maximum performance in respect of number of lambs weaned per ewe mated is obtained with four-year-old ewes but no connection between the ewe's first mating mass and the first reproduction performance was observed.

The repeatability of fertility as calculated for the first performance of the ewe as a forecast of the average performance in the second and third lambing seasons was estimated at 0,554, while the repeatability of fecundity as calculated for the first performance of the ewe and used as a forecast of the average performance in the second and third lambing seasons was estimated at 0,069.

The degree of heritability of fertility as calculated on ewes in the first, second and third lambing seasons was estimated at 0,448 ± 0,048, 0,336 ± 0,038 and 0,102 ± 0,013, respectively.

The degree of heritability of fecundity as calculated on ewes in the first, second and third lambing seasons was estimated at 0,097 ± 0,012, 0,017 ± 0,003 and 0,051 ± 0,007, respectively.

It was found that four-year-old ewes produced the maximum performance in respect of total mass of lambs weaned per ewe mated.

The degree of heritability of total mass of lambs weaned, as measured in the ewe's first lambing season, was calculated at 0,294 ± 0,126.

It was calculated that three to four-ewe age groups are optimal for maximum total meat production when lambs are marketed and no selection is applied. Where selection is applied at two-tooth age, an increase in total long-term meat production is obtained as the number of ewe age groups increases.

The results showed that the sexual activity of rams is affected by the seasons. Maximum activity was observed in the period from April to June, while the lowest level was reached in October. (Small sample).

As far as the repeatability of sexual behaviour was concerned, it was found that sexual activity as determined in any particular month, generally provided a very poor forecast of the performance in any other month. It was found, however, that the order of precedence in respect of mating dominance was very highly repeatable. (Small sample).

The results showed that sperm-cell concentration in the semen was not affected by seasonal factors. Against this a significant proportion of the variations in the percentages of dead sperms could be explained in terms of environmental temperature and daylight duration. (Small sample).

It was found that the sperm-cell concentration determined in any particular month was not a reliable indication of sperm concentration in any other month of the year. The percentage of dead sperms, however, was highly predictable.

A significant ($p<0{,}05$) curvilinear relationship was found between testosterone discharge in the urine and daylight duration. The maximum testosterone value was observed in April. (Small sample).

In regard to the predictability of testosterone discharge in the urine it was found that the values obtained in the period from January to May showed a significantly positive correlation in all combinations. The correlations between the months mentioned and any other month were generally low or even significantly negative. (Small sample).

the incidence of cryptorchidism. Also no connection was found to exist between cryptorchidism in rams and the reproduction performance of related ewes.

Of all male lambs 8,43% had horns and there was found to be a significant connection between polledness and the incidence of cryptorchidism. No connection was found to exist between the presence of horns in the case of rams and production characteristics.

It was found that the average inbreeding coefficient showed a highly significant ($p<0,01$) increase from 0% in 1942 to 21,13% in 1965. From 1965 to 1971 no further increase was observed. The inbreeding coefficient of the lamb was found to have a significant effect on mass increase (0-100 days) and mass at 100 days. Weaning mass, for example, will decrease by 0,78 kg for each 10% icrease in inbreeding coefficient. The inbreeding coefficient of the mother was not found to have any significant effect on the growth rate of the lamb or its mass at 100 days of age.

Body mass at the age of 1½, 2½ and 3½ years will decrease by 2,18; 2,73 and 3,70 kg, respectively, for each 10% increase in the inbreeding coefficient. The inbreeding coefficients of ewes with triplets were significantly lower than those of ewes with single or twin lambs. There was, however, no difference between the inbreeding coefficients of ewes with single lambs and ewes with twins or ewes which had skipped lambing.

No significant connection was found to exist between sexual aspects in rams and inbreeding coefficient. (Small sample). Lambs which survived to the age of 100 days had a lower average inbreeding coefficient than those which died before the age of 100 days. The average inbreeding coefficient of the mothers of the lambs which survived was also lower than those of other ewes.

Farm Birds

FOWLS

NUTRITION

(See Triticale on p. 119)

ZOOLOGY

FISH

J.D.F. Boomker:

HAEMOCYTOLOGY AND HISTOLOGY OF THE HAEMOPOIETIC ORGANS OF *CLARIAS GARIEPINUS* (BURCHELL) AND *SARATHERODON MOSSAMBICUS* (PETERS).
(Research project OP-PATH.38)
M.Sc., Rand Afrikaans University. 1978
Supervisor: Dr. J.H. Swanepoel

The haemocytology and histology of the haemopoietic organs of cold-water fish, notably those in the Northern Hemisphere, have been studied extensively. As regards the indigenous South African fish, only some haemotological parameters are known and the blood cells and the histology of the haemopoietic organs have not yet been studied.

The blood cells and the histology of the haemopoietic organs of *Clarias gariepinus* (catfish) and *Sarotherodon mossambicus* (Mozambique bream) are described in this investigation and the literature regarding the nomenclature of the blood cells is reviewed. Haemopoiesis and the ultrastructure of some of the blood cells are discussed.

Blood smears and sections of the haemopoietic organs of 15 catfish and 12 Mozambique bream were stained by various techniques to show the cell types to their best advantage. Electron-microscopic studies were done on circulating blood and on the haemopoietic organs, and correlated with the findings of the light microscopy investigation.

It was found that the erythrocytes of catfish are round and contain a round nucleus. Those of bream were generally oval with oval or bilobed nuclei. Eosinophils and basophils were lacking in catfish, but were present in bream. Neutrophils were present in both species.

Ultramicroscopy indicates a distinct similarity of the blood cells to those of other fish as well as those of mammals.

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Ultramicroscopy indicates a distinct similarity of the blood cells to those of other fish as well as those of mammals.

The main organs of haemopoiesis are the pronephros, the mesonephros and the spleen. This agrees with the results of studies of cold-water fish in the Northern Hemisphere. Under certain conditions the mesentery, intestinal mucosa and the bases of the gill filaments may act as secondary haemopoietic centres.

The different cell types which could be identified with certainty in blood and haemopoietic tissues are listed and a schematic representation of the possible mechanism of haemopoiesis is given.

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  - 77046 Pig and sheep scales, Atlas, model 300.
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  - 77014 Rovatti Centrifugal pups S_3 P 100 K.
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  - 77022 Waterbok Centrifugal pumps 2 L.
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BEMESTING/FERTILIZERS

N-Ce.19/13: Potato growing in the Natal Region: Soil fertility (N,P,K) studies and soil-test calibration on the major potato soils. 1977. R.J. Rutherfoord

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O-Gl.117/11(K): Grondvogtoestande by gewasverbouing: Stikstof en kaliumbemesting van aartappels by verskillende besproeiingsfrekwensies in die Douglas besproeiingsgebied. 1978. G.S. Cloete, H.L.G. Potgieter, J.P. van Dyk

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N-Ce.19/12: Potato growing in the Natal Region: Cultivar evaluation. 1977. R.J. Rutherfoord

*N-Ce.116: Evaluation of potato cultivars for the Natal Region. 1968. B.W. Young

T-Rp.12: Veredeling van aartappels:

  12/1: - Cultivarproef. 1963. F.I. du Plooy, S.W.L. de Kock, B.C. Greyling, A.F. Visser, G. van der Linde

  12/6: - Introduksie en evaluering van buitelandse aartappelcultivars. 1973. F.I. du Plooy, S.W.L. de Kock, B.C. Greyling, A.F. Visser, G. van der Linde

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  135/1: - Evaluasie van aartappelcultivars in die Winterreënstreek 1974. G.A. Agenbach, J.H. Blomerus, J.E. Wicht

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T-Rp.34: Biologie, ekologie en bestryding van die aartappelkewer, *Epilachna dregei*. 1960. A. Barnard

T-Rp.44: Studie van skadelike insekte (uitgesonderd virusvektore) by aartappels/Study of harmful insects in potatoes:

  44/1: - Beheer van snywurms (hoofsaaklik *Euxoa segetum*). 1978. R.J.H. Venter

***Project terminated**

***Projek beëindig**

T-Rp.44/2: - Beheer van swart mieliekewers *Heteronychus sanctae-helenae*. 1978. R.J.H. Venter

W-Sb.153: Insektekundige en verwante probleme by die verbouing van aartappels en aartappelmoere:

W-Sb.153/2: Migrasiegewoontes van die plantluisvektore van aartappelvirusse in die verskillende saadaartappel produserende gebiede van die Vrystaatstreek. 1977. T.C. Botha

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(A)I-Pr.87/2: Bio-ecology of the potato tuber moth: Utilization of imported natural enemies. 1966. R.H. Watmough.

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T-Rp.20/4: Virussiektes van aartappels: Vlugpatrone, heersende winde en bronne van luise met die oog op die voorspellingsdiens vir moerprodusente. 1976. R.J.H. Venter.

20/8: - Migrasiegewoontes van die plantluisvektore van aartappelvirusse. 1977. H. Bouwer, I. Griesel

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(A)PS-Pr.1/1: Methods of seed potato production. 1956. J.E. van der Plank, L.P. Meyer.

T-Rp.24/7: Agronomiese navorsing met aartappels: Invloed van moergrootte en spasiëring op moerproduksie onder droëlandtoestande. 1977. J.J. Bornman, K.P. Prinsloo, G.J. van der Linde

W-Sb.135: Aartappelproduksie in die Winterreënstreek:

*135/2: - Invloed van chemiese en fisiese stimulering op die agronomiese eienskappe van die aartappelcultivar van der Plank. 1976. G.A. Agenbag

ONKRUIDBEHEER/WEED CONTROL

W-Sb.135/3: Aartappelproduksie in die Winterreënstreek: Onkruidbeheer in aartappels. 1977. G.A. Agenbag, A.L.P. Cairns

OPBERGING/STORAGE

T-Rp.22: Koelopberging van aartappelmoere. 1968. F.I. du Plooy, A.C. Jandrell

T-Rp.24/8: Agronomiese navorsing met aartappels: Verdraagsaamheid van verskillende cultivars onder besproeiing teenoor vooropkomstoedienings van metribusin. 1978. T. Duvenhage, K.P. Prinsloo, G.P. van der Linde

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N-Ce.19: Potato growing in the Natal region:

19/2: - Yield of potato tubers as affected by spacing and fertilizer levels. 1965. R.D. Mould

19/11: - Effect of irrigation intensities on potato cultivar yields. 1974. R.D. Mould, R.J. Rutherfoord

T-Rp.12/4: Veredeling van aartappels: Invloed van planttyd oestyd en spasiëring op die opbrengs van verskillende aartappelcultivars. 1970. J.J. Bornman, K.P. Prinsloo

SIEKTES/DISEASES

N-Ce.125: Disorders of seed potato tubers:

125/1: - Incidence of pathogenic micro-organisms on the surface of potato tubers. 1973. B.W. Young

AARTAPPELS

125/2: - Black scurf and stem canker caused by *Rhizoctonia solani*. 1973. B.W. Young

*125/4: - Common scab caused by *Streptomyces scabies*. 1973. B.W. Young

*N-Pm.16: Tomato and potato late blight:

16/3: - Epidemiology of potato late blight in the Natal Region. 1957. B.W. Young

T-Rp.20: Aartappelvirussiektes:

20/1: - Beheer van aartappelbladrol deur sistemiese insekdoders. 1968. A. Barnard, R.J.H. Venter, M. Louw, D. du Toit, G. van der Linde

20/3: - Opsporing en identifikasie van aartappelvirussiektes. 1971. P.J. Prins, J.L.F. Dutrieux, E.A. Hemmes

20/5: - Virus diseases of potatoes: The inactivation of potato viruses by means of thermotherapy and meristem cultures. 1976. J.L.F. Dutrieux

20/6: - Virussiektes van aartappels: Beweging van die Aartappel Rolbladvirus (PLRV) in die aartappelplant. 1976. E.A. Hemmes

T-Rp.23: Swamsiektes van aartappels:

23/2: - Etiologie van puntjievrot en *Fusarium*-verwelksiekte van aartappels. 1968. A.C. Jandrell, J. van Reenen, G.G. Hill

23/4: - Voorspelling van aartappellaatroes-epidemies in die Transvaal. 1968. A.C. Jandrell, F.I. du Plooy, J.L.F. Dutrieux, J. van Reenen, A. Kotze, M.E.L. Buys, G.G. Hill

23/6: Studie en beheer van Bruinskurf - *Streptomyces scabies*. 1977. E.A. Hemmes

W-Sb.153: Insektekundige en verwante probleme by die verbouing van aartappels en aartappelmoere in die Winterreënstreek:

153/1: - Migrasiegewoontes van plantluisvektore van aartappelrolbladvirus (ARV) in die verskillende aartappelproduserende gebiede van die Winterreënstreek. 1974. S.S. Walters, F. du Toit

SKADELIKE DIERE- AALWURMS/HARMFUL ANIMALS - EELWORM

(A)I-Pr.115/1: Bio-ekologie en bestryding van die aartappelsistaalwurm *Heterodera rostochiensis* en die beetsistaalwurm *Heterodera schachtii* in Suid-Afrika: Ondersoek na die biologiese beheer van die aartappelsistaalwurm *Heterodera rostochiensis* in Suid-Afrika. 1972. K.P.N. Kleynhans

TELING/BREEDING

T-Rp.12: Veredeling van aartappels

12/2: - Teling. 1963. F.I. du Plooy, S.W.L. de Kock, A.F. Visser, B.C. Greyling, G. van der Linde

12/7: - Genetiese studies. 1973. A.F. Visser, F.I. du Plooy

ALGEMEEN/GENERAL

CULTIVARS

H-Ps.86: Research in connection with new introductions and crops not included in other projects. 1955. D.J. Crafford, C.J. Swanevelder

OK-Do.61/4: Maize in the Eastern Cape: Maize and sorghum cultivars for grain at Bathurst. 1968. R.R.S. Marr

INSEKTEMIDDELS - NABLYWING/INSECTICIDES - PERSISTENCE

(A)I-Pr.97/5:	Afbreking en vermindering van plaagbeheermiddelreste: Nablywing van insekdoders in opgebergde graan. 1973. P.R. de Beer, J.H. Viljoen

INSEKTEPLAE/INSECT PESTS

(A)I-Pr.134/1:	Studie van die voorkoms, aard en omvang van insekmiddelbestandheid by die belangrikste plaaginsekte van opgebergde graan in S.A.: Insekmiddelbestandheid by *Tribolium* spesies. 1975. J.H. Viljoen

PRODUKSIE/PRODUCTION

SW-Uk.4/1:	Droëlandse gewasproduksie in die noorde van Suidwes-Afrika: Aanpasbaarheid van somergewasse in die duineveld van Grootfontein. 1973. H.C. Hugo, J. van der Sandt

SIEKTES - DISEASES

*(A)PS-Pr.40:	Downy mildew fungi of maize and sorghums. 1971. G.C.A. van der Westhuizen

WISSELBOU/ROTATION

O-Vh.68/9:	Alternatiewe gewasse onder besproeiing: Wisselbou te Vaalharts. 1969. J. Dreyer, W. Jansen

BABALA

T-Rp.45:	Evaluation of *Pennisetum typhoides* as a fodder crop:
45/1:	- Babala cultivar trial. 1977. C.H. Donaldson, B.H. Robinson, G.T. Rootman

BOKWIET/BUCKWHEAT

CULTIVARS

T-Ng.65/1:	Bokwietnavorsing: Cultivarproewe. 1974. S.P. Fourie, E.B. Birch

BONE (DROOG)/BEANS (DRY)

CULTIVARS

H-Ps.238/1:	Droëboonteelt: Introduksie en evaluasie. 1970. W.J. Vermeulen
O-Vh.68:	Alternatiewe gewasse onder besproeiing:
68/3:	- Droëbone. 1964. A.J. Liebenberg

PRODUKSIE/PRODUCTION

H-Ps.249/1:	Produksievermoë van droëbone in die Hoëveldstreek: Produksievermoë van droëbone op 'n Soetmelk-grondserie in die Oos-Vrystaat. 1973. C.J. Swanevelder

SIEKTES/DISEASES

(A)PS-Pr.37:	Bakteriese siektes van akkerbougewasse:

GRAANSORGHUM

(A)PS-Pr.37/2: - Aard en omvang van saadgedraagde bakteriese siektes by gesertifiseerde boontjiesaad. 1974. C.C. Deschodt

TELING/BREEDING

H-Ps.238/2: Droëboonteelt: Teling van bone vir inmaakdoeleindes. 1970. W.J. Vermeulen

GARS/BARLEY

CULTIVARS

W-Sb.40/3(K): Evaluering van kleingrane: Evaluering van garslyne in die Winterreënstreek (Elite-garsproef). 1974. J.E. Wicht, B.J. Stander

PRODUKSIE/PRODUCTION

W-Sb.151: Produksie van brougars:

151/2: - Invloed van vebouingsmetodes op die opbrengs en kwaliteit van gars. 1974. B.J. Stander

TELING/BREEDING

W-Wg.10: Breeding new barley cultivars. 1976. B.E. Eisenberg

GRAANSORGHUMS/GRAIN SORGHUM

BEMESTING/FERTILIZERS

T-Tw.10: Bemesting en spasiëring van graansorghum. 1957. J.J. Coetzee

INSEKTEPLAE - BIOLOGIE/INSECT PESTS - BIOLOGY

(A)I-Pr.125: Biologie, ekologie en gedrag van die sorghumstamruspe, *Chilo zonellus*. 1965. H. van Hamburg

INSEKTEPLAE - INSEKTEMIDDELS/INSECT PESTS - INSECTICIDES

(A)I-Pr.97/4: Afbreking en vermindering van plaagbeheermiddelreste: Vermindering van plaagbeheermiddels op graansorghum. 1975. P.R. de Beer, N.J. van Rensburg

PRODUKSIE/PRODUCTION

H-Ps.247/1: Produksievermoë van graansorghums in die Hoëveldstreek: Produksievermoë van graansorghums op 'n Soetmelk-grondserie in die Oos-Vrystaat. 1973. G.P.Stemmet

GRONDBONE/GROUNDNUTS

AANPLANTING/PLANTING

H-Ps.255: Studie van die groei, ontwikkeling en reproduksie patrone by grondbone:

255/1: - Invloed van plantdatum op die ontwikkeling en reproduksie van Spanish-tipe. 1976. E.L. da Silva Ferreira

255/2: - Invloed van spasiëring op die reproduksie van grondbone. 1976. C.J. Swanevelder

BEMESTING/FERTILIZERS

N-Dd.3: Groundnut production in Natal:

3/11 - Calcium, magnesium and sulphur requirements of groundnuts on the 'Leksand' soil series. 1967. F.P.C. Blamey, J. Chapman

T-Tw.7: Bemesting en spasiëring van grondbone. 1957. J.J. Coetzee

BEWERKING/CULTIVATION

H-Ps.255/3: Studie van die groei, ontwikkeling en reproduksie patrone by grondbone: Invloed van grondbedekking (operd) op die reproduksie van grondbone. 1976. D.J. Theunissen

BLOMVOORKOMS/FLOWERING

H-Ps.255/4: Studie van die groei-, ontwikkeling- en reproduksiepatrone by grondbone: Blompatroon en reproduksiedoeltreffendheid van 'n Spanish-tipe grondboon. 1976. D.J. Theunissen

CULTIVARS

N-Dd.3: Groundnut production in Natal:

3/3: - Yield experiments. 1962. F.P.C. Blamey, J. Chapman

FISIOLOGIE/PHYSIOLOGY

H-Ps.255: Studie van die groei, ontwikkeling en reproduksiepatroon by grondbone (*Arachis hypogaea* L):

255/5: - Groei-analise van 'n Spanish-tipe grondboon. 1976. E.L. da Silva Ferreira

GRONDVOGVEREISTES/SOIL MOISTURE REQUIREMENTS

O-Gl.117/8: Grondvogtoestande by gewasverbouing: Strategiese vogbehoefte- en oesdatumbepalings met grondbone onder besproeiing. 1973. J. Dreyer, W. Jansen, A.J. Greyling, P.C.J. Dendy, E. Maree

ONKRUIDBESTRYDING/WEED CONTROL

H-Ps.31/3: Onkruidbestryding met onkruiddoders: Onkruidbestryding in grondbone. 1953. I.D. Hattingh

ONTKIEMING/GERMINATION

*O-Gl.148: Temperatuurondersoek van grondbone:

*148/1: - Invloed van ontkiemingstemperature op saailinggroei van grondbone. 1976. J. Dreyer

SIEKTES/DISEASES

H-Ps.261: Opbrengsverskille met volledige beheer deur chemiese middels soos beïnvloed deur groeiseisoenlengte. 1976. J. Dreyer

N-Dd.3/13: Groundnut production in the Natal Region: Epiphytology and control of foliar diseases in groundnuts in northern Natal. 1977. F.P.C. Blamey

O-Vh.76: Blaarsiektes van grondbone:

*O-Vh.*76/1: - Invloed van omgewingstoestande op die oorlewing van die patogene. 1976. G.J. de Swardt

*76/2: - Beheer met behulp van swamdoders. 1976. G.J. de Swardt

*76/3: - Opstel van 'n skaal vir die raming van die hoeveelheid siekte. 1976. G.J. de Swardt

TELING/BREEDING

H-Ps.243: Grondboonteling:

243/1: - Evaluering en klassifikasie van introduksies. 1974. P.J.A. van der Merwe

243/2: - Teling vir droëlandtoestande. 1974. P.J.A. van der Merwe

243/3: - Teling vir besproeiingsgebiede. 1974. P.J.A. van der Merwe

243/4: - Ondersoek na genetiese verskuiwing as gevolg van pitsifting. 1974. P.J. van Rooyen

HAWER/OATS

CULTIVARS

H.Bl.5: Cultivarproef met hawer. 1948. G.D. Joubert, H.A. Smit

O-Vh.68/6: Alternatiewe akkerbougewasse onder besproeiing: Hawercultivars. 1966. I.G. van Niekerk, H.B. Fick, J.H. Pienaar

W-Sb.40/2(K): Evaluering van kleingrane: Evaluering van hawerlyne in die Winterreënstreek (Elite-hawerproef). 1974. J.W. Loubser, J.E. Wicht, B.J. Stander

PRODUKSIE/PRODUCTION

W-Sb.143/3: Aanpassingstudies op wintergraansoorte met betrekking tot ligintensiteit, ligduurte, temperatuur en vogstrekking: Studie van die droëmateriaaldistribusie by hawer. 1970. J.H. Loots

TELING/BREEDING

W-Wg.9: Oat breeding. 1927. B.E. Eisenberg

KASTEROLIEPLANT/CASTOR-OIL PLANT

BEMESTING/FERTILIZERS

T-Tw.6: Bemesting en spasiëring van kasterolieplante. 1959. J.J. van der Merwe

KATOEN/COTTON

BESPROEIING/IRRIGATION

*O-Gl.117/9: Grondvogtoestande by gewasverbouing: Vogbehoeftes van katoen by verskillende plantdatums, besproeiingspeile en plantpopulasies. 1976. G.S. Cloete, C. Theron, W.J. van Staden, W. Jansen

T-Bt.11: Besproeiing van katoen in die Oos-Transvaalse Laeveld:

11/1: - Uitwerking van grondvogvariasie op opbrengs. 1966. M.C. Dippenaar

T-Lk.3: Vog en besproeiingsbehoeftes van katoen:

3/1: - Invloed van vogtekorte tydens verskillende groeiperiodes op katoen. 1977. M.C. Dippenaar

CULTIVARS

T-Lk.4: Katoenteling vir die westelike besproeiingsbebiede:

4/1: - Introduksie en evaluering van cultivars. 1963. C.G. Theron, W.H. van Staden

4/4: - Opbrengsproef. 1961. C.G. Theron, W.H. van Staden

4/5: - Cultivarproewe. 1960. C.G. Theron, W.H. van Staden

T-Lk.2: Veredeling van katoen:

2/2: - Introduksies. 1974. H.G. van Heerden, C.G. Theron, R.A. Gomes-Roderigues

2/4: - Nasionale cultivarproewe. 1975. H.G. van Heerden, C.G. Theron, M.C. Dippenaar

GRONDVOGVEREISTES/SOIL MOISTURE REQUIREMENTS

*O-Gl.117/2: Grondvogtoestande by gewasverbouing: Besproeiingspeile en strooideklae by katoenverbouing. 1967. J. de Kock

INSEKTEPLAE/INSECT PESTS

(A)I-Pr.103: Influence of pesticides, natural enemies and cultural practices on populations of *Tetranychus telarius*, *T. lombardinii* and *T. ludeni*. 1969. C.N. van Driel

(A)I-Pr.110: Geïntegreerde beheer van katoenplae. 1972. J.F. de Villiers, N.C.J. Basson

(A)I-Pr.133: Populasiedinamika van *Heliothis armigera* (Hübn.) in die Vaalharts-besproeiingsgebied. 1975. J.F. de Villiers

INSEKTEPLAE - INSEKTEMIDDELS/INSECT PESTS - INSECTICIDES

(A(I-Pr.97/3: Afbreking en vermindering van plaagbeheermiddelreste: Vermindering van plaagbeheermiddels op katoen. 1975. L.P. van Dyk, N.C.J. Basson

PRODUKSIE/PRODUCTION

O-Gl.117/5: Grondvogtoestande by gewasverbouing: Invloed van besproeiingspeile, stikstofpeile en plantbevolking op katoenproduksie. 1970. J. de Kock

O-Gl.132/4: Ondersoek na die rooidoodprobleem by katoen in die westelike besproeiingsgebiede: Invloed van vog, temperatuur, grondsterkte, lugvoorsiening en toeganklike voedingselementinhoud op die voeding en produksie van katoen. 1973. J. de Kock, M. van Z. Pellissier, G.S. Cloete

PRODUKSIEPRAKTYKE/PRODUCTION PRACTICES

T-Lk.1: Meganisasie van produksiepraktyke by katoen:

1/1: - Vergelykende studie van meganiesgeoesde en handgeplukte katoen. 1974. H.G. van Heerden

T-Lk.1/2: - Doeltreffendheid van chemiese bladvalmiddels onder verskillende toestande. 1975. M.C. Dippenaar

SIEKTES/DISEASES

*O-Gl.132/2: Ondersoek na rooidoodprobleem by katoen in die westelike besproeiingsgebiede: Evaluering van chemiese, fisiese en klimatologiese faktore. 1971. M. van Z. Pellisier, A. van Schalkwyk

O-Gl.136: Saailingverwelksiekte by katoen:

- *136/1: - Invloed van saadbehandeling met swamdoders. 1968. G.D. Pauer
- *136/2: - Studie van faktore wat die saprofitiese oorlewing van *Rhizoctonia solani* beïnvloed. 1975. G.J. de Swardt

SKADELIKE DIERE - AALWURMS/HARMFUL ANIMALS - EELWORMS

(A)I-Pr.120: Ondersoek na die bio-ekologie en beheer van aalwurms wat katoen in Suid-Afrika aanval. 1972. I.W. Botha

TELING/BREEDING

(A)S-Pr.57/4: Agroklimaat van die Hoëveld en O.V.S. streke: Invloed van klimaat. 1974. G.W.E.A Garlipp, H.G. van Heerden, G.C. Theron, M.C. Dippenaar

T-Lk.2: Veredeling van katoen:

- 2/1: - Teling en seleksie. 1974. H.G. van Heerden, C.G. Theron

T-Lk.4: Katoenteling vir die westelike besproeiingsgebiede:

- 4/2: - Terugkruising. 1963. C.G. Theron, W.H. van Staden
- 4/3: - Seleksie. 1953. C.G. Theron, W.H. van Staden
- 4/6: - Ondersoek na die natuurlike kruisbestuiwing van katoen op Upington. 1966. C.G. Theron
- 4/7: - Saadvermenigvuldiging. 1965. C.G. Theron, W.H. van Staden

KORING/WHEAT

BEMESTING/FERTILIZERS

O-Vh.75/5: Koringteling vir besproeiingsgebiede van die Oranje-Vrystaatstreek: Invloed van stikstofpeile, plantpopulasie en plantdatum op verskillende koringcultivars te Vaalharts. 1970. H.B. Fick, J.G. van Niekerk

SW-Hp.3/2: Koringproduksie op die Hardap besproeiingskema: Koringbemesting. 1973. G.S.P. Vink

W-Lg.4: Mis- en strooiproef met koring. 1937. J.E. Wicht

W-Sb.149/3: Kalibrering van chemiese ontledingsmetodes vir diagnostiese doeleindes: Invloed van kaliumbemestingspeile op die groei en opbrengs van koring. 1977. C.P. de L. Beyers

BESPROEIING/IRRIGATION

SW-Hp.3/4: Koringproduksie op die Hardap besproeiingskema: Besproeiingsbehoefte van koring. 1974. G.S.P. Vink

BEWERKING/CULTIVATION

O-Vh.1: Stoppelbewerking by koring en grondbone. 1952. J. Dreyer

SW-Hp.3/3:	Koringproduksie op die Hardapbesproeiingskema: Invloed van saaidightheid en planttyd op die opbrengs van sekere koringcultivars. 1973. G.S.P. Vink
W-Lg.7:	Grondbewerkingsproef met koring. 1933. J.E. Wicht, C.P. de L. Beyers
W-Lg.13/3:	Optimum integration of farming practices: Cultivation trial for possible improvement of wheat yield in prevailing production systems in the Rûens. 1976. J.E. Wicht, G.A. Agenbag, J.H. Loots, C.P. de L. Beyers, M.D. Strauss, F.J.C. Hugo

CULTIVARS

H-Bl.4/1:	Koringteling vir die somerreëngebied: Introduksie en evaluasie van cultivars. 1954. J.A.M. van der Mey, K.W. Pakendorf
*K-Gf.76:	Cultivarproef met koring. 1962. G.C. de Kock, B.A. Lötter
N-Dd.8/1:	Production of wheat in Natal: Introduction and evaluation of wheat cultivars for dryland production in Northern Natal. 1973. F.P.C. Blamey
OK-Do.71:	Kleingraan in die Oos-Kaap:
71/1:	- Koringcultivars vir droëlandproduksie. 1972. R.S. Marr
71/2:	- Koringcultivars onder besproeiing. 1972. R.S. Marr
O-Vh.75:	Koringteling vir die besproeiingsgebiede van die Oranje-Vrystaatstreek:
75/1:	- Strooisterktewaarneming by koring. 1956. J.H. Pienaar, H.B. Fick, J.G. van Niekerk
75/3:	- Koringcultivars. 1940. J.H. Pienaar, H.B. Fick, J.G. van Niekerk
SW-Hp.3/1:	Koringproduksie op die Hardap besproeiingskema: Koringcultivars. 1972. G.S.P. Vink
T-Rp.6(K):	Koringcultivarproewe op die vernaamste besproeiingskemas in die Transvaalstreek. 1961. J.A.M. van der Mey, I.B. Edwards
W-Sb.40:	Evaluering van kleingrane:
40/1(K):	- Evaluering van koringlyne in die Winterreënstreek (Elite-koringproef). 1974. J.E. Wicht, B.J. Stander, S.A. Barnard, J.H. Loots, J.W. Loubser
40/5:	- Evaluering van koringlyne onder besproeiing in die Winterreënstreek. 1974. S.A. Barnard, J.E. Wicht
40/6:	- Evaluering van alle vrygestelde koringcultivars ten opsigte van opbrengs en kwaliteit in die winter- en heeljaarreëngebiede. 1974. J.E. Wicht, B.J. Stander, J.E. Volschenk, A. Smit, S.A. Barnard, J.H. Blomerus, J.H. Loots, J.W. Loubser
W-Sb.143:	Aanpassingstudies op wintergraansoorte met betrekking tot ligintensiteit, ligduurte, temperatuur en vogstremming:
143/2:	- Invloed van vogstremming op die morfologie, osmotiese potensiaal en fotosintese gedurende opeenvolgende groeistadiums. 1972. J.E. van Niekerk
W-Sb.150/1:	Invloed van omgewingstoestande en verbouingsmetodes op die groeiwyse en agronomiese reaksie van koringcultivars: Invloed van klimaatsone op saaityd, saaidigtheid, bemesting en cultivarkombinasie. 1974. P.C.J. Maree, B.J. Stander, J.E. Volschenk, S.A. Barnard, J.M. Loots, J.E. Wicht, J.H. Blomerus

INSEKTEPLAE/INSECT PESTS

W-Sb.157:	Plantluise geassosieerd met kleingraanverbouing in die Winterreënstreek:
157/1:	- Identiteit en voorkoms van plantluise. 1977. F. du Toit, S.S. Walters

INSEKTEPLAE - BESTRYDING/INSECT PESTS - CONTROL

(A)I-Pr.24/3: Beheer van insekte in opgebergde saad en saadprodukte: Gebruik van bestraling vir die beheer van insekte in graan en graanprodukte. 1970. H. van Tonder

O-Gl.146: Beheer van koringluise met sistemiese insektedoders:

146/1: - Chemiese beheer van koringluise met demeton-S-metiel. 1974. T.C. Botha

146/2: - Opname van demeton-S-metiel deur koringplante en die faktore wat dit mag beïnvloed. 1974. T.C. Botha

ONKRUIDBESTRYDING/WEED CONTROL

H-Ps.31/4: Onkruidbestryding met onkruiddoders: Bestryding van onkruid in somerkoring. 1955. I.D. Hattingh

SIEKTES/DISEASES

H-Bl.67: Evaluering van koringcultivars vir roesbestandheid. 1967. J.N.W. de Jager

W-Sb.3: Stam- en blaarroes (*Puccinia graminis tritici* en *P.triticina*) van koring. 1954. J.A. Truter

TELING/BREEDING

H-Bl.4: Koringteling vir die somerreëngebied:

4/2: - Kombinasieteling vir ontwikkeling van uitstaande nuwe koringcultivars. 1965. J.A.M. van der Mey, J.N.W. de Jager, K.W. Pakendorf

4/3: - Terugkruising vir stamroesweerstand. 1954. J.A.M. van der Mey, J.N.W. de Jager, K.W. Pakendorf

4/5: - Bepaling van die erflike beheer van stamroesweerstand by koring en van die interverwantskappe van die weerstandsgene. 1964. J.A.M. van der Mey, J.N.W. de Jager, K.W. Pakendorf

T-Rp.2: Koringteling en -seleksie. 1954. I.B. Edwards, J.A.M. van der Mey, I.B. Edwards

W-Wg.6: Koringteling in die Winterreënstreek:

6/1: - Ondersoek na die genetiese komponente van variasie in broodkoring in die Winterreënstreek. 1974. G.F. Marais

6/2: - Skepping van variasie in die koringteeltprogram deur middel van fisiese en chemiese mutagense. 1974. H.A. van Niekerk, C.F. Quass

LUPIENE/LUPINS

CULTIVARS

W-Lg.9: Cultivarproef met lupiene. 1958. J.E. Wicht

INSEKTEPLAE/INSECT PESTS

W-Sb.17: Biologie en bestryding van *Heliothis armigera* by lupiene in die Winterreënstreek. 1956. S.S. Walters

SIEKTES/DISEASES

W-Sb.152/1:	Lupiensiektes in die Winterreënstreek: Ondersoek na die voorkoms van siektes by lupiene in die Winterreënstreek. 1975. A.B. van Jaarsveld

TELING/BREEDING

W-Wg.4:	Teling van lupiene. 1943. K.W. Pakendorf

LUSERN/LUCERNE

BEMESTING/FERTILIZERS

OK-Do.62:	Mineral nutrition of lucerne:
62/8:	- Effect of Iscor open-hearth slag compared with calcium carbonate on soil pH and phosphorus uptake by lucerne. 1973. R.B.A. Harry
W-Oh.7:	Lusernverbouing in die Klein Karoo:
7/2:	- Bemesting van lusern vir hooi- en saadproduksie. 1974. S.A. Barnard, D.J. Beukes, G.A. Agenbag, J.E. Wicht
W-Oq.3:	Kalk- en kaliumproef met lusern. 1954. G.R. Thompson, J.H. Blomerus

BESPROEIING/IRRIGATION

W-Oh.7:	Lusernverbouing in die Klein Karoo:
7/1:	- Besproeiing volgens panverdamping vir optimale hooi- en saadproduksie. 1974. S.A. Barnard, D.J. Beukes, G.A. Agenbag

CULTIVARS

*K-Gf.33:	Studie van lusernbevolkings in verskillende omgewings. 1958. G.C. de Kock
K-Gf.69:	Brakbestandheid van luserncultivars. 1961. G.C. de Kock
N-Ce.80/3:	Lucerne in Natal: Evaluation of cultivars, strains and selections. 1962. D. le Roux

HOOI - PRESERVERING/HAY - PRESERVATION

*W-Oq.19:	Preservering van hooi in die humiede Georgegebied met chemiese preserveermiddels. 1972. J.E. Wicht, J.H. Blomerus

INSEKTEPLAE/INSECT PESTS

*W-Lv.1:	Die witsykantkewer, *Graphognathus leucoloma*. 1956. S.S. Walters
W-Sb.31/1:	Bestryding van die lusernerdvlooi (*Sminthurus viridis*) en die swart sandmyt (*Halotydeus destructor*).1960. J. Lombard

PRODUKSIE/PRODUCTION

W-Oh.7/3:	Lusernverbouing in die Klein Karoo: Beweiding van lusern deur volstruise teenoor hooiproduksie. 1974. D.J. Beukes, J.E. Wicht

SIEKTES/DISEASES

(A)PS-Pr.33:	Lusernsiektes in die Republiek van Suid-Afrika:

TELING/BREEDING

K-Gf.10: Teling van lusern. 1935. G.C. de Kock, B.A. Lötter

MIELIES/MAIZE

AANPLANTING/PLANTING

O-Vh.69/1: Mielieverbouing op Vaalharts: Optimale plantdigtheid en bemesting van mieliecultivars. 1965. J. Dreyer

*T-Tw.16: Spasiëring van optimale bevolking by mielies. 1960. J.J. Coetzee

BEMESTING/FERTILIZERS

H-Bl.46: Bemestings- en wisselbouproef met mielies. 1959

H.Bl.47: Lime and organic matter experiment with maize. 1959

H-Ps.38: Quantitative fertilizer experiment with maize. 1922. D.J. Crafford

N-Ce.106/1: Fertility studies on the major soil series in Natal:

106/1: - Response of maize to N, P, K and Ca applications on an Avalon medium sandy loam. 1966. M.P.W. Farina

N-Dd.4: Effect of incorporation of stover on yield and fertilizer requirements of maize. 1966. F.P.C. Blamey

*O-Gl.71: Invloed van bemesting en inploeg van stronke op mielieopbrengste. 1959. J. Dreyer, A.J. Greyling

SW-Uk.3/1(K): Bemestingsproewe in die droëland akkerboustreke van Suidwes-Afrika: Bemestingsbehoeftes van mielies in die noorde van Suidwes-Afrika. 1973. H.C. Hugo, J.C. van der Sandt

T-Tw.4(K): Bemesting en spasiëring van mielies. 1957. J.J. Coetzee

T-Tw.12: Stikstofbemesting van mielies. 1960. J.J. Coetzee

T-Tw.13: Voedingselementvoorsiening aan mielies. 1961. J.J. Coetzee

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O-Gl.19: Mieliecultivars. 1943. J. Dreyer

O-Gl.93: Mieliecultivars onder besproeiing op die Sand-Vetskema. 1961. J. Dreyer
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OK-Do.61/3: Maize in the Eastern Cape: Maize cultivars for grain at Dohne. 1968. R.S. Marr

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*N-Ce.104/2: Maize growth studies in the Natal Midlands: Utilization of radiant energy by canopies of different age and plant density. 1969. H.W. Kaiser, J. de Jager

INSEKTEPLAE/INSECT PESTS

H-Ps.104/5: Mieliestamrusper: Bepaling van ekonomiese skadedrumpel vir die mieliestamrusper *Brusseola fusca* Fuller. 1976. J.B.J. van Rensburg

INSEKTEPLAE - BESTRYDING/INSECT PESTS - CONTROL

H-Ps.104:	Proef met die mieliestamrusper:
104/1:	- Chemiese beheer. 1959. T.W. Drinkwater, M.C. Walters, J.W.J. van Rensburg
104/2:	- Meganiese beheer. 1959. M.C. Walters
H-Ps.258:	Blaarspringers (Homoptera:Cicadelliadae) as vektore van streepsiekte by mielies (*Zea mays* L.).
258/1:	- Taksonomie van die genus *Cicadulina* China. 1977. G.D.J. van Rensburg
W-Sb.67:	Ligrooi mieliestamrusper (*Sesamia calamistis*) in die Winterreënstreek:
67/2:	- Chemiese bestryding. 1959. S.S. Walters

INSEKTEPLAE - BIOLOGIE/INSECT PESTS - BIOLOGY

W-Sb.67/1:	Die ligrooi mieliestamrusper (*Sesamia calamistis*) in die Winterreënstreek: Biologie. 1959. S.S. Walters

INSEKTEPLAE - EKOLOGIE/INSECT PESTS - ECOLOGY

H-Ps.104/4:	Proef met mieliestamrusper: Ekologie. 1959. M.C. Walters

ONKRUIDBESTRYDING/WEED CONTROL

H-Ps.31/1:	Onkruidbestryding met onkruiddoders: Onkruidbestryding in mielies. 1950. I.D. Hattingh
N-Ce.129/2:	Mieliegraanproduksie in die Natalstreek: Onkruiddoderproewe. 1973. J.B. Mallett

PLANT/PLANTING

(A)S-Pr.57/2:	Agroklimaat van die Hoëveld- en O.V.S. streke: Invloed van weerkundige faktore op die groeitempo van mielies. 1976. R. Eicker

PRODUKSIE/PRODUCTION

H-Ps.245/1:	Produksievermoë van mielies in die Hoëveldstreek: Produksievermoë van mielies op 'n Soetmelk grondserie in die Oos-Vrystaat. 1973. J.P. Pretorius
N-Ce.129/1:	Maize grain production in the Natal Region: Performance of maize hybrids at varying plant populations. 1973. J.B. Mallett
N-Vl.16/5:	Promotion of maize production in the Natal Region: Promotion of improved yields by economic optimum fertilization and improved cultural practices in the Winterton soil conservation district. 1976. B.A. Scott

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(A)PS-Pr.55:	Invloed van landbouchemikalieë op die voorkoms en beheer van blaasbrand. 1976. L.J. Mills, J.M. Kotze
N-Ce.69:	Screening of promising maize breeding stocks for resistance to *Helminthosporium turcicum* leaf blight. 1961. H.O. Gevers, J. Lake

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H-Ps.227:	Genetiese beheer van die biochemiese komponente van mielies:

227/2: - Verhoging van lisieninhoud van mieliegraan. 1967. J.G. du Plessis

227/3: - Teling van suikermielies. 1974. J.G. du Plessis

H-Ps.236: Bestandheidsteling van mielies teen siektes:

236/1 - Diplodia stamvrot (*D. zeae*). 1968. J.G. du Plessis

236/2: - Blaasbrand (*Ustilago maydis*). 1969. H.J. Maree

236/3: - Kop- en pluimbrand (*Sorosporium reilianum*). 1952. J.G. du Plessis

H-Ps.251: Ontwikkeling van teelmetodiek by mielies:

251/1: - Suiwerlynontwikkeling uit verbeterde teelpopulasies van mielies. 1975. H.C. Kühn

H-Ps.252: Seleksie vir morfologiese- en fisiologiese hoedanighede by mielies:

252/1: - Teling vir stamsterkte by mielies. 1975. A.P. Fourie

N-Ul.20: Breeding of hybrid maize for Natal.

20/1: - Genetics of photoperiodism in maize. 1972. J. Spencer

N-Ul.35: Reciprocal recurrent selection as a method of maize breeding with and without visual selection for agronomic characters. 1958. H.O. Gevers

SG-Ps.3: Mielieteling vir weerstandbiedendheid teen streepsiekte:

3/1: - Introduksie en evaluasie van teelmateriaal. 1968. J. Dreyer, J.H. Pienaar

3/2: - Kruisingsprogram. 1968. J. Dreyer, J.H. Pienaar

3/3: - Genepoëlteeltprogram. 1968. J. Dreyer, J.H. Pienaar

3/4: - Evaluasie van nuwe basters. 1969. J. Dreyer, J.H. Pienaar

WISSELBOU/ROTATION

H-Bl.28: Grondverbetering deur middel van wisselbou. 1955

H-Ps.33: Grasrusoes- en wisselbouproef. 1953. D.J. Crafford

H-Ps.37: Wisselbou en grondbewerking vir mielies. 1953

ROG/RYE

CULTIVARS

W-Sb.40/4: Evaluering van kleingrane: Evaluering van roglyne in die Winterreënstreek (Elite Rogproef). 1974. J.E. Wicht, B.J. Stander

RYS/RICE

ONKRUIDBESTRYDING/WEED CONTROL

T-Bt.13/1: Rysverbouing in die Oos-Transvaalse Laeveld: Chemiese onkruidbeheer. 1967. M.C. Dippenaar

SIGOREI/CHICORY

CULTIVARS

OK-Bh.7: Sigorei in die Oos-Kaap:

7/2: – Cultivars. 1974. A.A. Rotter, J.D. Aucamp

7/6: – Studie van die groei en ontwikkeling van sigoreicultivars. 1975. J.D. Aucamp

ONKRUIDDODERS HERBICIDES

OK-Bt.7/4: Sigorei in die Oos-Kaap: Onkruiddoders. 1974. J.D. Aucamp

SAADPRODUKSIE SEED PRODUCTION

OK-Bt.7/3: Sigorei in die Oos-Kaap: Saadproduksie. 1974. J.D. Aucamp

SOJABONE SOYBEANS

CULTIVARS

H-Bt.11: Cultivarproef met sojabone. 1948.

H-Ps.212/1: Sojabone: Cultivarproewe. 1964. C.J. Swanevelder

PRODUKSIE PRODUCTION

H-Bt.62/1: Verbouing van sojabone in die Oos-Vrystaat: Plantdigtheid en spasiëring. 1968

H-Ps.248/1: Produksievermoë van sojabone in die Hoëveldstreek: Produksievermoë van sojabone op 'n Soetmelk-grondserie in die Oos-Vrystaat. 1973. C.J. Swanevelder

TELING BREEDING

H-Ps.4: Teling van sojabone. 1926. P.J. van Rooyen

N-Dj.49: Soya bean breeding in the Natal Region. 1968. Rona V. van Niekerk

SONNEBLOMME SUNFLOWER

BEMESTING FERTILIZERS

N-Dd.10/4: Boron nutrition of sunflowers on a Doveton clay loam. 1976. F.P.C. Blamey, J. Chapman

10/5: – Sunflower production in the Natal Region: Nitrogen and phosphorus fertilization of sunflowers on a Doveton clay loam. 1976. P.F.C. Blamey

PRODUKSIE PRODUCTION

H-Ps.246/1: Produksievermoë van sonneblomme in die Hoëveldstreek: Produksievermoë van sonneblomme op 'n Soetmelk grondserie in die Oos-Vrystaat. 1973. C.J. Swanevelder

N-Dd.10: Sunflower production in the Natal Region:

N-Dd.10/1: Introduction and evaluation of sunflower cultivars for Northern Natal. 1974. F.P.C. Blamey, J. Chapman

TELING BREEDING

H-Ps.244: Sonneblomteling:

244/1: – Introduksie en evaluering. 1974. W.J. Vermeulen

244/2: - Teling van oopbestuifde cultivars. 1974. W.J. Vermeulen

244/3: - Teling van lyne vir bastersaadproduksie. 1974. W.J. Vermeulen

244/4: - Kombineervermoë tussen oopbestuifde cultivars. 1974. P.J. van Rooyen

TABAK/TOBACCO

BEMESTING/FERTILIZERS

(S)T.4: Ekstraksiemetodes vir die bepaling van toeganklike fosfaat en die korrelasie met groei en opbrengs van tabak. 1956. H.G. Snyman

(S)T.20: Katioonvoeding van tabak:

20/11: - Invloed van tye van toediening op stikstofopname deur tabak. 1972. J.J. du Toit

20/12: - Stikstofindekse vir en stikstoflewering van tabakproduserende gronde en in besonder die Arcadia-serie. 1972. J.J. du Toit

20/13: - Gevoeligheid van tabak teen aluminium toksisiteit. 1973. J.J. du Toit, P.J. Shawe

20/14: - Spoorelementvoeding van tabak. 1973. (susp.)

20/15: - Bepaling van die verwantskap tussen die voedingselementstatus van gronde in die verskillende tabakproduserende gebiede en die chemiese samestelling en opbrengs van tabak. 1973. J.J. du Toit, H.J. Boshoff, F.J. Shawe

BIOCHEMIE/BIOCHEMISTRY

(S)T.132/1: Control of suckers in tobacco: Efficacy tests with chemical sucker control agents. 1968. Louise van der Westhuizen

(S)T.310: Faktore wat tabakrooksamestelling beïnvloed:

310/1: - Skeiding, identifikasie en kwantitatiewe bepaling van tabakrookkomponente. 1965. J.G. Nel

310/2: - Fisiese en chemiese eienskappe van blaartabak en die invloed daarvan op rooksamestelling en blaarkwaliteit. 1965. J.G. Nel

310/3: - Invloed van vorige verbouings- en prosesseringsgeskiedenis van tabak op die samestelling van die blare en rook. 1965. J.G. Nel

(S)T.315/1: Residu's van chemiese bestrydings- en beheermiddels op tabak: Afbraak van insekbestrydingsmiddels op tabak. 1969. R.J. van Wyk

CULTIVARS

(S)T.109: Cultivarproewe met tabak:

109/1: - Oonddroogtabak. 1951. M.P. Lamprecht

109/2: - Donker lugdroogtabak. 1965. M.P. Lamprecht

109/3: - Ligte lugdroogtabak. 1965. M.P. Lamprecht

109/4: - Burleytabak. 1956. M.P. Lamprecht

109/5: - Cultivarproewe met tabak in die Klein-Karoo. 1968

109/6: - Turkse tabak. 1917. W.J.C. van der Merwe

GRONDVRUGBAARHEID/SOIL FERTILITY

*(S)T.21: Opname van die chloorgehalte van tabak en faktore wat dit beïnvloed. 1964.

HIDROLOGIE/HYDROLOGY

(S)T.131: Waterhuishouding van die tabakplant:

131/3: - Invloed van vloed- en sprinkelbesproeiing van oonddroogtabak. 1968. Louise van der Westhuizen

131/6: - Besproeiingspraktyke vir die vestiging van plantjies op kleigrondwalle. 1976. E. van der Westhuizen

INSEKTEPLAE/INSECT PESTS

(S)T.207/2: Biology and control of insects in field tobacco: Studies on insect transmission of the tobacco leaf-curl virus. 1967. J. Thatcher

(S)T.209: Ondersoeke na die sporadiese voorkoms en beheer van tabakinsekte wat gedurende spesifieke seisoene van onmiddellike belang kan wees. 1973. E. Eulitz

(S)T.210: Amerikaanse bolwurm - biologie en beheer van die plaag op tabak:

210/1: - Vestiging van 'n bolwurmkultuur. 1977. E.G. Eulitz

INSEKTEPLAE - INSEKTEMIDDELS/INSECT PESTS - INSECTICIDES

(S)T.208/2: Biology and control of insects in stored tobacco: Chemical control of the cigarette beetle, *Lasioderma serricorne*, in tobacco warehouses. 1969. J.M. Els,

ONKRUIDBEHEER/WEED CONTROL

(S)T.133/1: Weed control in tobacco: Efficacy of chemical control. 1968. Louise van der Westhuizen

SIEKTES/DISEASES

(S)T.211: Potato virus Y-group virus of burley tobacco in the R.S.A.:

211/1: - Purification and electron microscopy of PVY-group virus of burley tobacco. 1977. J. Thatcher

(S)T.306: Beheer van tabaksaadbeddingsiektes:

306/1: - Swart wortelvrot van tabak veroorsaak deur die swam *Thielaviopsis basicola* (Berk. en B.) Ferraris en die beheer daarvan. 1977. R.J. van Wyk

(S)T.309/1: Studie van die voorkoms en bestryding van die rooiroessiekte by tabak: Besmettingstegnieke. 1965. R.J. van Wyk

(S)T.313/2: Studies met plantpatogeniese *Pseudomonas*-spesies met spesiale verwysing na dié wat tabak parasiteer: Isolasie van die veroorsakende organisme(s), tegnieke vir kunsmatige besmetting en beheer van hoekvlek by tabak. 1971. R.J. van Wyk

(S)T.316: Ondersoeke na die sporadiese voorkoms en beheer van tabaksiektes wat gedurende spesifieke seisoene van onmiddellike belang kan wees. 1973. J. Thatcher

(S)T.317: Studie oor die voorkoms en beheer van die swartstamsiekte van tabak (*Phytophthora nicotianae* var *nicotianae*). 1973. G.C. Prinsloo

SKADELIKE DIERE - AALWURMS/HARMFUL ANIMALS - EELWORMS

(S)T.204: Control, distribution and effect of temperature and host resistance on *Meloidogyne* spp. of tobacco and the role of other nematodes and methods of extraction:

204/2: - Chemical control of eelworm in tobacco seedbeds. 1959. J.M. Els

204/7: - Plant parasitic eelworms (Not *Meloidogyne*) on tobacco. 1959. J.M. Els,

SPASIËRING/SPACING

(S)T.129: Spasiëring en top van tabak:
- 129/1: - Oonddroogtabak. 1966. M.P. Lamprecht
- 129/2: - Donker lugdroogtabak. 1966. M.P. Lamprecht
- 129/3: - Ligte lugdroogtabak. 1966. M.P. Lamprecht
- 129/4: - Burley tabak. 1966. M.P. Lamprecht
- 129/5: - Spasiëring en top van donker lugdroogtabak in die Klein Karoo. 1968

TELING/BREEDING

(S)T.111: Teling van *Nicotiana tabacum* cultivars weerstandbiedend of imuun teen knopwortelnematodes (Meloidogyne spp.). 1958. A.P.F. Cornelissen

(S)T.113: Inteling van die manlik-steriliteitsfaktor in sommige *Nicotiana tabacum* cultivars. 1956. A.P.F. Cornelissen

(S)T.128: Teelwaardebepaling by *Nicotiana tabacum*:
- 128/1: - Donker lugdroogtabak. 1962. M.P. Lamprecht
- 128/2: - Oonddroogtabak. 1961. M.P. Lamprecht
- 128/3: - Ligte lugdroogtabak. 1967. M.P. Lamprecht, S.E. van der Westhuizen
- 128/4: - Burley tobacco. 1969. M.P. Lamprecht
- 128/5: - Seleksie van siekteweerstandbiedende tabak, 1952. M.P. Lamprecht
- 128/6: - Gebruik van haploide plante in tabakteling. 1976. S.E. v.d. Westhuizen

WISSELBOU/ROTATION

(S)T.135: Verbouing van tabak direk na koring onder besproeiing:
- 135/1: - Plantmetodes en bewerking in Wes-Transvaal. 1976. Louise van der Westhuizen

VOERGEWASSE/FORAGE CROPS

BEMESTING/FERTILIZERS

O-Gl.142: Produksie- en benuttingsmoontlikhede van voergewasse op droëland in die Oranje-Vrystaatstreek:
- *142/2: - Bemestingstudies met eenjarige voersorghums. 1974. C. Engelbrecht

EVALUERING/EVALUATION

N-Ce.134: Evaluation of pasture plants in the Natal Region:
- 134/1: - Evaluation of *Digitaria* ecotypes as pasture grasses. 1973. A. Smith
- 134/2: - Evaluation of South African clovers as pasture legumes. 1973. A. Smith
- 134/3: - Evaluation of *Lotononis* species as pasture legumes. 1973. A. Smith

W-Tk.3: Evaluation of pastures and sheep management practices in the Rûens area of the Southern Cape:
- 3/6: - Investigation of the suitability of Mediteranean pasture species to specific environments and to grazing conditions in the Winter Rainfall Region. 1973. J.M. van Heerden, J.D. Langenhoven

FORAGE CROPS

INTRODUKSIESTUDIES/INTRODUCTION STUDIES

K-Gf.98/1: Seleksie en teling van droogtebestande voergewasse vir die Karoostreek: Introduksiestudies. 1964. G.C. de Kock

KUILVOER/SILAGE

H-Ps.215/1: Kuilvoerproduksie: Bemestings-, bevolkings- en rywydteproef met Gramineae-kuilvoergewasse. 1964. D.J. Crafford

OUMANSOUTBOS/OLD MAN SALT BUSH

K-Gf.98: Seleksie en teling van droogtebestande voergewasse vir die Karoostreek:

98/3: - Verbetering van oumansoutbos (*Atriplex nummularia*).1962. G.C. de Kock, B.A. Lötter

PRODUKSIE/PRODUCTION

K-Gf.79: Groenvoerproduksie van kleingraancultivars. 1963. G.C. de Kock

N-Ce.139/5: Systems specifications and simulations for extension use: Linear programme for forage crop production planning. 1977. R.I. Jones

O-Gl.142: Produksie- en benuttingsmoontlikhede van voergewasse op droëland in die Oranje-Vrystaatstreek:

*142/1: - Invloed van ryspasiëring, plantdigtheid en snystadium op die hooi-opbrengs van eenjarige voersorghums. 1974. C. Engelbrecht

142/3: - Plantdatum en cultivarproef met verskeie eenjarige voersorghumbasters. 1974. C. Engelbrecht

SIEKTES/DISEASES

(A)PS-Pr.41: Studie van saadgedraagde swamme en saadgedraagde swamsiektes en hul beheer in Suid-Afrika:

41/3: - Studie van saadgedraagde swamsiektes van Japanse radyssaad en hul beheer in Suid-Afrika. 1975. M.A. Holtzhauzen

TURKSVY/PRICKLY PEAR

K-Gf.98/2: Seleksie en teling van droogtebestande voergewasse vir die Karoostreek: Verbetering van doringlose turksvye. 1962. G.C. de Kock, B.A. Lötter

*98/4: - Sitogenetiese ondersoek van die vernaamste turksvycultivars (*Opuntia spp*). 1966. G.C. de Kock

*K-Gf.111/4: Benutting van droogtebestande voergewasse: Vasstelling van moontlike voedingstekorte in doringlose turksvyblaaie. 1969. C.W.P. Steenkamp

K-Kn.2: Droogtebestande voergewasse vir die noordwestelike distrikte van die Karoostreek:

*2/2: - Besproeiingsbehoefte van doringlose turksvye (*Opuntia* spp). 1964. G.C. de Kock

VERSAMELING/COLLECTION

*K-Kn.2/1: Droogtebestande voergewasse vir die noordwestelike distrikte van die Karoostreek: Introduksiestudies. 1964. G.C. de Kock

VOORLIGTING/EXTENSION

N-Ce.143: Data collation for annual fodder crops in Natal Region:
    143/1: - Maize. 1976. F.R. Hyam
    143/2: - Winter cereals. 1977. F.R. Hyam
    143/3: - Cruciferous crops. 1977. F.R. Hyam
    143/4: - Millets. 1977. F.R. Hyam
    143/5: - Legumes. 1977. F.R. Hyam
    143/6: - Sorghums. 1977. F.R. Hyam

Algemeen/General

BYEFLORA/BEE FLORA

(A)I-Pr.99: Nectar and pollen flora of the Republic of South Africa: (See also p. 246)
    99/5: - Indigenous plants, ornamentals and weeds. 1975. M.F. Johannsmeier

MIKROBIOLOGIE/MICROBIOLOGY

MICORRHIZAE

*(A)PS-Pr.34: Vesicular-arbuscular Mycorrhizae. 1970. F.C. Wehner

SKADELIKE DIERE/HARMFUL ANIMALS

KNAAGDIERE/RODENTS

(A)I-Pr.101: Studie van die biologie, ekologie en bestryding van muise en rotte as landbouplae. 1969. Seugnet Stiemie

NAGMUISE/GERBILLES

W-Sb.75/1: Bestryding van die Kaapse nagmuis *Tatera afra afra*. 1964. S.S. Walters

WAARDEBEPALING/EVALUATION

SUBTROPIESE GEWASSE/SUBTROPICAL CROPS

(S)N.137: Bepaling van die potensiaal van subtropiese gewasse:
    137/1: - Aanpassingstudies. 1975. A.J. Joubert, N.W. Smyth, K. de Rooster, A.I.J. Bester, J.P. Carstens, F.A. Kuhne

Groente/Vegetables

ALGEMEEN/GENERAL

SAADINSTANDHOUDING/SEED MAINTENANCE

(A)T-Rp.160: Instandhouding en produksie van verbeterde voortplantingsmateriaal en teler- of basissaad van groentegewasse:

160/1: - Produksie en instandhouding van virusgetoetste groentecultivars. 1975. P.J. Klesser, D.D. Nel, E.J.S. du Plessis, C.W. Roux

160/2: - Instandhouding van teler- of basissaad van groentegewasse. 1975. T.G. la G. Joubert, C.M. Weber, C.W. Roux

SKADELIKE DIERE - AALWURM/HARMFUL ANIMALS - EELWORM

(A)I-Pr.115: Bio-ekologie en bestryding van die aartappelsistaalwurm *Heterodera rostochiensis* en die beetsistaalwurm *Heterodera schachtii* in Suid-Afrika:

115/2: - Ondersoek na die ekonomiese belangrikheid, biologie, ekologie en beheer van die beetsistaalwurm *Heterodera schachtii* in Suid-Afrika. 1972. Valerie,

H. Meaton

BLOMKOOL/CAULIFLOWER

CULTIVARS

(A)T-Rp.153/2/1: Verhoging van die produksiepotensiaal van koolgewasse in Suid-Afrika: Blomkool. 1975. A.F. Coertze, C.E. Rappard, A.G. Comrie, P.F. Nortjé, S.E. Bosch, J.J. Wagner

TELING/BREEDING

(A)T-Rp.153/1/1: Teling en seleksie: Blomkool. 1975. A.F. Coertze

BONE (GROEN)/BEANS (GREEN)

CULTIVARS

(A)T-Rp.155/2/1: Evaluering van nuwe groenbooncultivars en teellyne in die verskillende produksiegebiede. 1975. A.F. Coertze, A.G. Comrie, J.J. Wagner, P.F. Nortjé, S.E. Bosch

SIEKTES/DISEASES

(A)T-Pr.155/4: Verhoging van die produksie-potensiaal van groenbone in Suid-Afrika: Siektebeheerstudies. 1975.

155/4/1: - Toets van boontjiecultivars vir bestandheid teen vetvleksiekte. 1975. B.H. Boelema

TELING/BREEDING

(A)T-Rp.155/1: Teling en seleksie van groenbone in Suid-Afrika. 1975.

155/1/1: - Teling en seleksie van groenbone vir prosessering doeleindes. 1975. A.F. Coertze

VERBOUING/CULTIVATION

(A)T-Rp.155/3/1: Spasieringsproewe met groenbone. 1975. A.F. Coertze

CRUCIFERAE

SIEKTES/DISEASES

N-Ce.140: Control of diseases of Cruciferae in Natal Region:

140/1: - Control of Black Rot of Cruciferae, caused by *Xanthomonas campestris*. 1976. M.J. Morris

ERTE (GROEN)/PEAS (GREEN)

BESPROEIING/IRRIGATION

(A)T-Rp.110: Waterverbruik en besproeiing van groenerte. 1967. O.J. Olivier

CULTIVARS

(A)T-Rp.154/2: Waardebepaling van groenertcultivars en teellyne. 1975. J.A. van Blommestein, A.G. Comrie, C.E. Rappard, J.J. Wagner, W.D. Going

KLIMAAT/CLIMATE

(A)T-Rp.154/3: Studie van die klimaatsvereistes van groenerte. 1975. J. Myburgh, J.J. Wagner

TELING/BREEDING

(A)T-Rp.154/1: Verhoging van die produksiepotensiaal van groenerte in Suid-Afrika: Teling. 1976. J.A. van Blommestein

KNOFFEL/GARLIC

VERBOUING/CULTIVATION

(A)T-Rp.141: Verbouingstudies met knoffel. 1972. O.J. Olivier, P.J. Henrico

KOPKOOL/CABBAGE

CULTIVARS

(A)T-Rp.153/2/2: Verhoging van die produksie-potensiaal van koolgewasse in Suid-Afrika: Evaluasie in die verskillende produksiegebiede: Kopkool. 1975. P.J. Henrico, A.G. Comrie, P.F. Nortjé, J.J. Wagner, S.E. Bosch

INSEKTEPLAE - INSEKTEMIDDELS/INSECT PESTS - INSECTICIDES

(A)I-Pr.97/2: Afbreking en vermindering van plaagbeheermiddelreste: Vermindering van plaagbeheermiddels op kool. 1973. Mareli Krause

PAMPOENGEWASSE/CUCURBITS

SIEKTES/DISEASES

(A)T-Bt.6/1: Mosaïekvirusse by pampoengewasse in die Transvaalse Laeveld: Biologie en ekologie van die vektor plantluise. 1973. E.G. Eulitz

TELING/BREEDING

(A)T-Rp.156/1/2: Verhoging van die potensiaal van rankgewasproduksie: Teling: Pampoene en Skorsies. 1976. J.A. van Blommestein

VERBOUING/CULTIVATION

(A)T-Rp.63: Verbouingstudies met pampoengewasse. 1959. O.J. Olivier

PATATS/SWEET POTATO

CULTIVARS

(A)T-Rp.152: Verhoging van die produksiepotensiaal van wortelagtige gewasse in Suid-Afrika: Evaluasie van wortelagtige gewasse in die verskillende produksiegebiede:

152/2/1: - Patats. 1976. S.E. Bosch, J.J. Wagner, C.L. Bester, T.G. la G. Joubert, C.E. Rappard, P.F. Nortjé

TELING/BREEDING

(A)T-Rp.152/1/1: Teling en seleksie: Patats. 1975. T.G. la G. Joubert

VOEDINGSTATUS/NUTRITIONAL STATUS

(A)T-Rp.152/3/1: Grond, voeding en bemesting: Patats. 1975.

RANKGEWASSE/MELONS

CULTIVARS

(A)T-Rp.156/2/1: Verhoging van die potensiaal van rankgewasproduksie: Evaluasie in die verskillende produksiegebiede: Spanspekke en waatlemoene. 1976. J.J.B. van Zijl, C.L. Bester

TELING/BREEDING

(A)T-Rp.156/1/1: Verhoging van die potensiaal van rankgewasproduksie: Teling en seleksie: Spanspekke. 1976. J.J.B. van Zijl

TAMATIE/TOMATO

CULTIVARS

(A)T-Rp.148/2: Evaluasie van tamatiecultivars in die verskillende produksiegebiede. 1975. A.S. Oosthuizen, S.E. Bosch, C. L. Bester, J.J. Wagner, W.D. Going

148/2/1: - Marktamaties. 1975. A.S.A. Oosthuizen, S.E. Bosch, C. L. Bester, J.J. Wagner, W.D. Going, P.F. Nortjé

TOMATO

(A)T-Rp.148/2/2: - Inmaaktamaties. 1975. A.S.A. Oosthuizen, S.E. Bosch, C. L. Bester, J.J. Wagner, W.D. Going

INSEKTE/INSECTS

(A)T-Rp.148/6: Verhoging van die potensiaal van tamatieproduksie in Suid-Afrika: Plaagbeheerstudies -

148/6/1: - Insekdodertoetse en diagnostiese ondersoek en evaluasie van onbekende plae. 1975. C.C. Daiber

ONKRUIDBESTRYDING/WEED CONTROL

(A)T-Rp.148/3/4: Onkruidbeheerstudies. 1975. A.S.A. Oosthuizen

SIEKTES/DISEASES

(A)T-Rp.148/5: Verhoging van die potensiaal van tamatieproduksie in Suid-Afrika: Siektebeheerstudies -

148/5/1: - Swamdodertoetse en diagnostiese ondersoek van die oorsake van onbekende siekteverskynsels by tamaties. 1975. B.H. Boelema, S. Visser

148/5/2: - Toets van *Lycopersicon*-plantmateriaal vir bestandheid teen bakteriese kanker. 1975. B.H. Boelema

148/5/3: - Kwantitatiewe ondersoek na die epidemiologie van *Verticillium*-verwelksiekte by tamaties. 1975. S. Visser

TELING/BREEDING

(A)T-Rp.148/1: Teling en seleksie van tamaties. 1975. A.S.A. Oosthuizen, J.J.B. van Zijl, A. Louw, S.E. Bosch, C.L. Bester, B.H. Boelema, S. Visser

148/1/1: - Marktamaties. 1975. A. Louw, A.S.A. Oosthuizen, S.E. Bosch, J.J.B. van Zijl

148/1/2: - Inmaaktamaties. 1975. A. Louw, A.S.A. Oosthuizen, S.E. Bosch, J.J.B. van Zijl, B.H. Boelema, S. Visser, C.L. Bester

VERBOUINGSPRAKTYKE/CULTURAL PRACTICES

(A)T-Rp.148: Verhoging van die potensiaal van tamatieproduksie in Suid-Afrika: Verbouingspraktyke:

148/3/1: - Produksie onder beskerming. 1973. A.S.A. Oosthuizen, A.G. Comrie

148/3/2: - Manipulasie van die gewas. 1975. A.S.A. Oosthuizen

148/3/3: - Wisselboustudies. 1975. O.J. Olivier, P.J. Henrico, S. Visser

VOEDINGSTATUS/NUTRITIONAL STATUS

(A)T-Rp.148: Increasing the potential of tomato production in South Africa:

148/4: - Establishing criteria for assessing the normal nutritional status of tomatoes. 1975

UIE/ONIONS

CULTIVARS

(A)T-Rp.157/2/1: Verhoging van die potensiaal van bolgroentes: Evaluasie van uie in die verskillende produksiegebiede. 1976. T.G. la G. Joubert, P.J. Henrico, P.F. Nortjé, S.E. Bosch, J.J.B. van Zijl, J.J. Wagner, O.J. Olivier

SAADPRODUKSIE/SEED PRODUCTION

W-Vl.17/22(K): Produksie van groentesaad: Koöperatiewe proef om verskillende produksietegnieke van uiesaadproduksie uit te toets. 1976. B.F.A. Visser

SIEKTES/DISEASES

(A)PS-Pr.41/1: Studies of seed-borne fungi and seed-borne fungus diseases and their control in South Africa: Fungus flora of onion seed. 1973. G.C.A. van der Westhuizen

VEREDELING/IMPROVEMENT

(A)T-Rp.157/1/1: Verhoging van die potensiaal van bolgroentes: Veredeling en seleksie van uie. 1976. T.G. la G. Joubert, J.J.B. van Zijl

Medisinale plante en kruie/Medicinal plants and herbs

ALGEMEEN/GENERAL

VERSAMELING/COLLECTION

(A)T-Rp.159/2: Instandhouding van versamelings van kruie, medisinale plante en plante met vlugtige olies. 1975. P.N. van den Bergh

BOEGOE/BUCHU

VERBOUING/CULTIVATION

*(S)WP.182/1: Verbouing van boegoe (*Agathosma betulina*, *A. crenulata*): Voortplantingsmetodes. 1970. K.L.J. Blommaert

VERWERKING/PROCESSING

(S)WP.182/2: Verbouing van boegoe (*Agathosma betulina*, *A. crenulata*): Verwerking van boegoe. 1971. B.K. Nortjé

Neute/Nuts

AMANDELS/ALMONDS

CULTIVARS

(S)WP.166/15: Evaluering van ingevoerde en plaaslikgeselekteerde en -geteelde cultivars en onderstamme van bladwisselende vrugte en neute: Amandelcultivars. 1971. E.J. van Zyl

VERBOUING/CULTIVATION

(S)WP.242: Allerlei bessie- en sagtevrugte: Verbouing in die winterreënvalgebied. 1978. (Sien ook: Bessievrugte en kersies)

MACADAMIA

BEMESTING/FERTILIZERS

(S)N.97/1:	Voedingsbehoeftes van die macadamia: Reaksie van macadamia op N-, P- en K-toediening. 1968. T.J. Koen, W. Langenegger

CULTIVARS

(S)N.96:	Macadamiastudies:
96/1:	- Evaluasie van seleksies in die Republiek van Suid-Afrika. 1968. A.J. Joubert
96/4:	- Lokaliteitsproewe met belowende macadamiaseleksies en -cultivars in Suid-Afrika. 1969. A.J. Joubert

MORFOLOGIE/MORPHOLOGY

(S)N.96/5:	Macadamiastudies: Anatomies-morfologiese studie van die blom- en vrugontwikkeling by die macadamia. 1970. A.J. Joubert

VERBOUING/CULTIVATION

(S)N.96/6:	Macadamiastudies: PLantafstande vir macadamiabome. 1971. A.J. Joubert

PEKAN/PECAN

BEMESTING/FERTILIZERS

(S)N.106/1:	Voedingsbehoeftes van die pekanneut: Reaksie van pekanneute op N-, P- en K-toediening ten opsigte van oes en blaarsamestelling. 1969. T.J. Koen, W. Langenegger

CULTIVARS

(A)T-Rp.163/1/1:	Pekanneute: Evaluering van pekanneutcultivars in die Hoëveld en Middelveld. 1975. T. Haulik, K.G. Zwahlen
(S)N.124/1:	Tuinboukundige aspekte van die pekanneut: Uittoets van verskillende cultivars. 1971. A.J. Joubert

Plantasiegewasse/Plantation crops

HOUT/TIMBER

BIOLOGIESE BEHEER/BIOLOGICAL CONTROL

(A)I-Pr.128:	Studies oor die biologiese beheer van ses Australiese *Acacia* spp wat indringers is van plantasies en inheemse flora. 1975. M.A. van den Berg

BYEFLORA/BEE FLORA

(A)I-Pr.99/3:	Nectar and pollen flora of the Republic of South Africa: (See also p. 246) *Eucalyptus* spp. 1976. M.F. Johannsmeier

INSEKTEPLAE/INSECT PESTS

(A)I-Pr.72: Bio-ecology and control of dry-wood and timber insects:

72/3: - *In situ* treatment of wood-borer infested timber. 1953. H. Geertsema

(A)I-Pr.143: Ondersoek na die bio-ekologie en plaagstatus van die swart denneplantluis *Cinara cronartii* T & P in denneplantasies en die biologiese beheer van hierdie plantluis deur die invoer van natuurlike vyande. 1978. N.J. van Rensburg

SIEKTES/DISEASES

(A)PS-Pr.45: Siektes van bosbome in Suid-Afrika:

45/1: - Roetine ondersoek van siek plantmateriaal vanuit bosbouplantasies. 1975

45/2: - Opname van plantsiektes in bosbouplantasies in die Republiek van Suid-Afrika. 1975

45/3: - Ondersoek van saailingsiektes in bosboukwekerye. 1975

KOFFIE/COFFEE

CULTIVARS

(S)N.79: Koffienavorsing in die Transvaalse Laeveld:

*79/5: - Cultivars - Friedenheim. 1968. K. de Rooster

SNOEI/PRUNING

(S)N.79/2: Koffienavorsing in die Transvaalse Laeveld: Snoeimetodes. 1965. K. de Rooster

PHORMIUM TENAX

PRODUKSIE/PRODUCTION

N-Ce.83/8: *Phormium tenax* production in the Natal Region: Effect of fertilization and weed control on the yield of an existing phormium plantation. 1970. R.D. Mould

SISAL

BEMESTING/FERTILIZERS

N-Ce.86/2: Sisal production in the Natal Region: Fertilizer and plant population study. 1966. R.D. Mould

PRODUKSIE/PRODUCTION

N-Ce.86/1: Effect of severity, regularity and stage of commencement of cutting on the yield of sisal. 1964. R.D. Mould

TEE/TEA

BEMESTING/FERTILIZERS

(S)N.138: Voedingsbehoeftes van tee:

138/1: - Bemestingsproef met N, K, Ca en Mg. 1975. P.C. van Zyl, J.F. Waldeck

CULTIVARS

(S)N.122/1: Teeseleksie. 1971. K. de Rooster

Sierplante/Ornamentals

ALGEMEEN/GENERAL

KIEMPLASMA/GERM PLASM

(A)T-Rp.159/1: Produksie, her-indeksering en instandhouding van virusgetoetste klone. 1975. P.J. Klesser, D.D. Nel, E.J.S. du Plessis, C.W. Roux

(A)T-Rp.159/3: To maintain and multiply improved plant material: Maintainance of collection of flowers and shrubs for research purposes and functional utilization of ornamental plants in a garden design surrounding an extensive building complex. 1976. C.W. Roux

MIDDELS/REMEDIES

(A)T-Rp.158/1/1: Verhoging van produksiepotensiaal van blom- en sierplante: Siektebeheerstudies; Diagnostiese ondersoek na nuwe swam-en bakteriedoders by sier- en blomplante. 1975. B.H. Boelema, S. Visser

(A)T-Rp.158/2/1: Verhoging van die produksiepotensiaal van blom- en sierplante vir snyblomme, sowel as sierplante vir tuine in Suid-Afrika: Plaagbeheerstudies; Diagnostiese ondersoek na plae en evaluering van beheermiddels. 1976. M.C. Bolton

BLOMPLANTE/FLOWERING PLANTS

ONKRUIDDODERS/HERBICIDES

(A)T-Rp.111/1: Evaluering van nuwe onkruiddoders by tuinbougewasse: Evaluering van nuwe onkruiddoders by blomme. 1967

VIROLOGIE/VIROLOGY

(A)T-Rp.159/1 To maintain and multiply improved plant material: Production, re-indexing and maintainance of virus tested clones of flowering plants. 1976. Patricia Klesser, D.D. Nel, E.J.S. du Plessis, C.W. Roux

BOLPLANTE/BULBOUS PLANTS

INSEKTEMIDDELS/INSECTICIDES

(A)T-Rp.150/3/1: Diagnostiese ondersoek na nuwe plae en waardebepalings van nuwe insekmiddels by blombolplante. 1975. C.C. Daiber

PLAE/PESTS

(A)T-Rp.150/3: Plaagbeheerstudies by blomplante. 1975. C.C. Daiber

SIEKTES/DISEASES

(A)T-Rp.150/4: Beheerstudies by blombolplante. 1975.

    150/4/1: - Diagnostiese ondersoek na en waardebepaling van nuwe middels by blombolplante. 1975. B.H. Boelema, S. Visser

    150/4/2: - Studie van virussiektes by blombolplante. 1975. Patricia KLesser, D.D. Nel

TELING/BREEDING

(A)T-Rp.150/1/1: Verhoging van die produksiepotensiaal van blomplante: Veredeling van die genus *Lachenalia*. 1975. J. Lubbinge

150/1/2: - Veredeling van die genus *Ornithogalum*. 1975. J. Lubbinge

150/1/3: - Veredeling van die genus *Gladiolus*. 1975. J. Lubbinge

POTPLANTE/POT PLANTS

ONTWIKKELING/DEVELOPMENT

(A)T-Rp.151/1: Development and improvement of certain species of flowering plants for use as pot plants. 1975.

151/1/3: - Pelargonium: P.*hortorum* and P. *domesticum*. 1975. H.L. Pearse

151/1/4: - Bougainvillea species. 1975. H.L. Pearse

151/1/5: - Various plants indigenous to South Africa. 1975. H.L. Pearse

PROTEA

CULTIVARS

(A)T-Rp.149/6: Ontwikkeling van Proteaceae as kommersiële snyblomme in Suid-Afrika: Registrasie en evaluasie van nuwe cultivars vir vrystelling aan die bedryf.1975. G.J. Brits, M.N. van Niekerk

INDENTIFISERING/INDENTIFICATION

(A)T-Rp.149/1: Identifisering en beskrywing van Proteaceae-spesies vir die bedryf en vir navorsing. 1975. G.J. Brits

PLAAGBEHEER

(A)T-Rp.149/7: Ontwikkeling van Proteaceae as kommersiële snyblomme in Suid-Afrika: Beheer van plae by verboude proteas. 1977. C. Kok

SIEKTES/DISEASES

*(A)T-Rp.149/8: Ontwikkeling van Proteaceae as kommersiële snyblomme in Suid-Afrika: Siektes van verboude proteas. 1975. W.F.S. Schwabe

TELING/BREEDING

(A)T-Rp.149/5: Ontwikkeling van Proteaceae as kommersiële snyblomme in Suid-Afrika: Veredeling. 1975. G.J. Brits, M.N. van Niekerk

VERBOUING/CULTIVATION

(A)T-Rp.149/4: Ontwikkeling van Proteaceae as kommersiële snyblomme in Suid-Afrika: Boordverbouing. 1977. G.J. Brits, M.N. van Niekerk, P. van den Bergh

VERSAMELING/COLLECTION

(A)T-Rp.149/2: Proteaceae-versameling, vestiging en instandhouding van navorsingsmateriaal. 1975. M.N. van Niekerk, G.J. Brits, P.N. van den Bergh

VOORTPLANTING/REPRODUCTION

(A)T-Rp.149/3: Ontwikkeling van Proteaceae as kommersële snyblomme in Suid-Afrika: Voortplantingstudies.

149/3/1: - Vegetatiewe studies. 1975. G.J. Brits, M.N. van Niekerk

149/3/2: - Voortplanting deur saad en diverse metodes. 1975. G.J. Brits, M.N. van Niekerk

ROSE/ROSES

SIEKTES/DISEASES

(A)T-Rp.158/1/2: Verhoging van die produksiepotensiaal van blom- en sierplante: Siektebeheerstudies: Ondersoek na die simptome en ontwikkeling van verticillium-verwelksiekte by rose soos dit onder plaaslike toestande voorkom en die moontlike beheer daarvan. 1976. S. Visser

Vrugte/Fruit

AARBEIE/STRAWBERRIES

CULTIVARS

(S)WP.187/3: Aarbeiverbouing: Evaluasie van aarbeiseleksies. 1973. C.W.J. Bester

KWALITEITSTUDIES/QUALITY STUDIES

*(S)WP.207/7: Kwaliteitstudies; Verpakking en verkoeling van aarbeie vir luguitvoer. 1974. A.B. Truter

TELING/BREEDING

(A)T-Rp.163/2/1: Verhoging van die potensiaal van neut-, bessie- en ander minder belangrike sagtevrugsoorte in die somrreëngebied: Aarbeie: Teling en seleksie van nuwe cultivars. 1976. E.P. Evans

(S)WP.246: Teling van verbeterde aarbeicultivars:

246/2: - Benutting van die genetiese variasie op oktoploïede vlak vir die ontwikkeling van cultivars geskik vir bevriesing, inmaak en uitvoer. 1972. W.G. Wenzel

246/3: - Benutting van genetiese variasie by verwante en wilde vorms van die aarbei. 1972. W.G. Wenzel

VERBOUING/CULTIVATION

(S)WP.187: Aarbeiverbouing

187/5: - Produksieverhoging by aarbeie. 1975. C.W.J. Bester

VOEDINGSTOFOPNAME/NUTRIENT ABSORPTION

(S)WP.175: Seisoensopname van voedingstowwe deur sagtevrugte, bome en bessies:

175/2: - Seisoensopname en verspreiding van tien essensiële voedingselemente (N, P, K, Ca, Mg, Mn, Fe, Cu, B en Zn) by die aarbeicultivar Parfaite, gekweek in sandkultuur. 1972. J.H. Terblanche

ALGEMEEN/GENERAL

BEMESTING/FERTILIZERS

(S)WP.229: Soil studies in connection with pome and stone fruit and table grape cultivation in the Winter Rainfall area:

229/1: - Potassium supplying power of selected orchard soils. 1977. J. Woolridge

BESPROEIING/IRRIGATION

(S)WP.254: Waterbehoeftes van tafeldruiwe, kern- en steenvrugte. 1978

254/3: Soil moisture distribution under drip irrigation in soils of the Western Cape. 1975. F.C. van Rooyen

BESTRALING/IRRADIATION

(S)WP.185/4: Benutting van ioniserende straling in die landbou: Bestraling van sade en ogies van vrugtebome. 1971. J.H.M. Karsten, Johanna F. de Villiers

CULTIVARS

(S)WP.166/18: Evaluering van ingevoerde en plaaslikgeselekteerde en -geteelde cultivars en onderstamme van bladwisselende vrugte en neute: Tegniek vir die bepaling van natbestandheid van onderstamme vir steenvrugte. 1972. P.J.C. Stassen

HERVESTIGING/REPLANTING

(S)WP.243: Diverse toegewese gewasse: Verbouing in die winterreënvalgebied. 1978

INSEKTEPLAE/INSECT PESTS

(A)I-Pr.21: Identification and classification of African Trypetidae (fruit flies). 1921. H.K. Munro

*(S)WP.32: Bionomie en bestryding van die kodlingmot, *Carpocapsa pomonella*. 1933. A.C. Myburgh

(S)WP.233: Steenvrugte: Bionomie en ekologie van plae. 1977

(S)WP.234: Kernvrugte: Chemiese en fisiese beheer van plae

234/2: - Chemiese beheer van kodlingmot in kernvrugte. 1977. A.C. Myburgh

(S)WP.235: Sagtevrugte: Na-oesfitosanitêre beheermaatreëls vir plae. 1977

(S)WP.236: Kernvrugte: Bionomie en ekologie van plae. 1977

INSEKTEPLAE - BESTRYDING/INSECT PESTS - CONTROL

(S)N.121/1: Valskodlingmotstudies: Sterilisasie van valskodling mot, *Phlebia leucotreta*, deur gammabestraling. 1971. A. Schwartz, W.J. du Toit.

(S)WP.161: Bionomie en beheer van myte op sagtevrugtebome, wingerd en sierstruike:

*161/1: - Beheer van die gewone rooispinmyt, *Tretranychus telarius*, op vrugtebome en wingerd, met spesiale verwysing na chemiese beheermaatreëls. 1967. K.L. Pringle

(S)WP.213: Na-oessterilisasie van uitvoersagtevrugte, -tafeldruiwe, -droëvrugte en ander toegewese uitvoergewasse om insek- en verwante plaagbesmettings te vernietig:

213/2: - Sterilization by radiation of the fruit flies *Pterandrus rosa* and *Ceratitis capitata*. 1972. B.N. Barnes

(S)WP.236/4: - Ecology and integrated control of the common red spider mite, *Tetranychus cinnabarinus* and the European red mite, *Panonychus ulmi*. 1972. K.L. Pringle

KWEKERYSIEKTES/NURSERY DISEASES

(A)PS-Pr.43: Swam- en bakteriesiektes van kwarantynbelang in wingerd- en sagtevrugtekwekerye:

*43/1: - Kroongal veroorsaak deur *Agrobacterium tumefaciens* in wingerd- en sagtevrugtekwekerye. 1975. J.T. Loubser

*43/2: - Root-rotting fungi of quarantine importance in deciduous fruit and grapevine nurseries. 1975. J.T. Loubser

ONKRUIDDODERS/HERBICIDES

(A)T-Rp.111/2: Evaluation of new herbicides for horticultural crops: Evaluation of new herbicides for decidous fruit and strawberries in the summer rainfall area. 1972

OPBERGING/STORAGE

(S)WP.253: Koelopbergingstudies in verband met tafeldruiwe, kern- en steenvrugte:

*(S)WP-Ks.12: Storage of miscellaneous fruits. 1950. L. Ginsburg

SIEKTES/DISEASES

(A)PS-Pr.39: Viruses and virus diseases of deciduous fruits (pome and stone):

39/1: - Detection and identification of viruses in pome and stone fruits. 1970. D.J. Engelbrecht

*39/2: - Elimination of viruses in pome and stone fruits. 1970. D.J. Engelbrecht

(S)N.140. Tristeza virus complex

140/2: - Basic research. 1976. T.N. Trench

(S)WP.166/13: Evaluering van ingevoerde en plaaslikgeselekteerde en -geteelde cultivars en onderstamme van bladwisselende vrugte en neute: Invloed van die virusstatus op die prestasie van Beurr Hardy, Packham's Triumph, Doyenne du Comice en Bon Chrétien pere en Golden Delicious appels. 1972. H.J. van Zyl

(S)WP.189/5: Voorkoms en beheer van na-oes bederfsiektes by tafeldruiwe, kern- en steenvrugte: Gebruik van chloor as ontsmettingsmiddel tydens waterhantering van appels. 1977. C.J. Combrink

*(S)WP.208/3: Bogrondse swamsiektes van sagtevrugte, tafeldruiwe en ander toegewese gewasse: Geskiktheid van verskillende chemiese produkte as wondbedekkingsmiddels en entwasse. 1972. A.C. Thomas. 1973. P.J. Prins

TEGNOLOGIE/TECHNOLOGY

(S)WP.151/3: Voedselskeikundige siektes: Samestelling van sagtevrugte. 1974. B.K. Nortjé

(S)WP.195: Droging van vrugte en groente

TELING/BREEDING

(S)WP.246: Allerlei sagte- en bessievrugte: Teel van verbeterde cultivars. 1978. W.G. Wenzel

VERBOUINGSPRAKTYKE/PRODUCTION PRACTICES

(S)WP.179: Water-, plant- en grondverhoudings:

(S)WP.211/6: Voeding van bladwisselende vrugte en bessies: Uitwerking van verskillende grondbewerkingspraktyke op boomprestasie en fisiese en chemiese grondeienskappe. 1974. G.K. Schliemann

(S)WP.216/1: Tegnieke vir die toediening van plantbeskermingsmiddels by sagtevrugte en tafeldruiwe: Vergelyking van lae en ultra-lae volume met konvensionele hoë volume bespuitingstegnieke vir die beheer van siektes by appels en tafeldruiwe. 1972. F.N. Matthee

VOEDINGSTOFOPNAME/NUTRIENT UPTAKE

(S)WP.211: Voeding van bladwisselende vrugte en tafeldruiwe. 1972

(S)WP229/3: Demonstrasie bemestingsproewe by vrugtebome. 1973. J.H. Terblanche

(S)WP.255: Opname en translokasie van voedingselemente by tafeldruiwe, kern- en steenvrugte. 1978

VOORTPLANTING/PROPAGATION

(A)T-Rp.165: Instandhouding en produksie van verbeterde voortplantingsmateriaal van sagtevrugte en verwante gewasse:

- 165/1: - Produksie en instandhouding van virusgetoetste sagtevrugte, tafeldruif en ander vrugte cultivars. 1977. Patricia Klesser, D.D. Nel, E.J.S. du Plessis, C.W. Roux, K.G. Zwahlen

(S)WP.165: Kwekerypraktyke vir bladwisselende vrugtebome:

WINDSKUTTE/WIND BREAKS

(A)S-Pr.58/4: Verbetering van mikroklimaat: Hoöe palmetstelsels as windskutte vir pruime. 1977. G.K. Viljoen, P.R. Jolly

APPEL/APPLE

BESTRALING/IRRADIATION

(S)WP.185: Benutting van ioniserende straling in die landbou:

- *185/1: - Bestraling van appelsap. 1971. B.K. Nortjé

BIOCHEMIE/BIOCHEMISTRY

(S)WP.172: Bitterpit by appels:

- *172/1: - Spuitbehandelings teen bitterpit. 1968. J.H. Terblanche
- 172/5: - Ontwikkeling van 'n metode om die intensiteit van bitterpit te voorspel. 1971. J.H. Terblanche
- 172/7: - Invloed van groeireguleerders op die voorkoms van bitterpit. 1976. J. Steenkamp
- *172/9: - Invloed van groeireguleerders op die opname en verspreiding van kalsium in die appelplant. 1976. J. Steenkamp
- 172/10: - Faktore wat die opname van kalsium-45 deur appelvrugte beïnvloed. 1975. A.N. Hanekom
- 172/11: - Na-oes kalsium doopbehandelings vir beheer van bitterpit. 1976. G.J. Eksteen
- *172/12: - Invloed van snelheid van voorverkoeling op die voorkoms van bitterpit. 1976. G.J. Eksteen
- 172/13: - Na-oes voorspelling van bitterpit. 1976. G.J. Eksteen

APPEL

(S)WP.232/1: Pome fruits: Harvest and post-harvest fruit physiology: Maturity indices for apples. 1978. H. Tormann, T.R. Visagie

CULTIVARS

(S)WP.166: Evaluering van ingevoerde en plaaslikgeselekteerde en -geteelde cultivars en onderstamme van bladwisselende vrugte en neute:

166/10: - Appelcultivars en -seleksies. 1971. J.D. Stadler

(S)WP.178/1: Aanplanting en instandhouding van bestaande en nuwe cultivars en onderstamme van kern- en steenvrugte, neute, bessies en olywe: Appelcultivars. 1970. J.V. Hadlow

INSEKTEPLAE/INSECT PESTS

(S)WP.234/3: Pome fruits: Chemical and physical control of pests: Chemical control of snoutbeetles in apple orchards. 1977. B.N. Barnes, P.L. Swart

(S)WP.236/1: Pome fruits: Bionomics and ecology of pests: Development of a system for monitoring snoutbeetle populations in apple orchards. 1978. B.N. Barnes, P.L. Swart

236/2: - Rearing leafrollers in the laboratory. 1977. T.L. Blomefield

*236/3: - Development of a monitoring system for leafroller population in apple orchards. 1977. T.L. Blomefield, K.L. Pringle

OESBEHEER/CROP CONTROL

(S)WP.168: Oesbeheer by bladwisselende vrugtebome:

168/4: - Vergelyking van die ope senter (kelk)-, palmet- en piramiedopleistelsels by appels en die vasstelling van die beste plaaslike plantafstande vir palmet en piramied. 1969. J.D. Stadler, O. Bergh

168/10: - Snoeimetodes vir nougeplante appelboorde. 1972. O. Bergh

168/12: - Vergelyking tussen die ope senter (kelk), piramied, vrye spil en slanke spil opleistelsels by verskillende appelcultivars op dwergende en semidwergende onderstamme. 1972. O. Bergh

ONDERSTAMME/ROOTSTOCKS

(S)WP.166/14: Evaluering van ingevoerde en plaaslikgeselekteerde en -geteelde cultivars en onderstamme van bladwisselende vrugte en neute: Ingevoerde appelonderstamme. 1971. O. Bergh

OPBERGING/STORAGE

*(S)WP-Ks.7: Storage of apples. 1950. L. Ginsburg

SIEKTES/DISEASES

(S)WP.193/3: Kraag- en wortelvrot by kernvrugte en wingerd: Bestandheid van appelklone-onderstamme. 1973. F.N. Matthee, H.J. Hugo

(S)WP.209: Koelopbergingskwale van vrugte, groente en blomme:

*209/2: - Kommersiële metode om oppervlakkige brandvlek op appels deur middel van antioksideermiddel-emulsies te beheer. 1972. G.J. Eksteen

(S)WP.241/4: Fisiologiese kwale van tafeldruiwe, kern- en steenvrugte: Rol van organiese sure by die inbeweging en vaslegging van kalsium by appels. 1978. J. Steenkamp

(S)WP.255/2: Factors affecting the immobilisation of calcium in apple trees. 1977. L.G. Wooldridge

(S)WP.256: Fusikladiumsiekte van appels:
256/1: - Development of an apple scab warning service. 1972. W.F.S. Schwabe

TEGNOLOGIE/TECHNOLOGY

(S)WP.238: Kernvrugte: Verwerking:
238/1: - Appelversnaperings. 1978. C.F. Hansmann
238/2: - Appeldranke. 1978. J.F. du T. Hugo

TELING/BREEDING

(S)WP.227: Teel van verbeterde appelcultivars:
227/1: - Teel van 'n laat rooi appelcultivar. 1977. N. Hurter, M.J. van Tonder
227/2: - Teel van cultivars wat teen skurfsiekte bestand is. 1977. N. Hurter, M.J. van Tonder
227/3: - Teel van 'n Granny Smith tipe met 'n kompakte groeiwyse. 1978. N. Hurter, M.J. van Tonder
227/4: - Ontwikkeling van weefselkultuurtegnieke met die oog op mutasieteelt by apples. 1978. Rachel, E. Pieterse

VOEDINGSTOFOPNAME/NUTRIENT ABSORPTION

(S)WP.175: Seisoensopname van voedingstowwe deur sagtevrugte, bome en bessies:

APPELKOOS/APRICOT

CULTIVARS

(S)WP.166/11: Evaluering van ingevoerde en plaaslikgeselekteerde en -geteelde cultivars en onderstamme van bladwisselende vrugte en neute: Appelkooscultivars en -seleksies. 1971. C.W.J. Bester, J.D. Stadler

(S)WP.178/4: Aanplanting en instandhouding van bestaande en nuwe cultivars en onderstamme van kern- en steenvrugte, neute, bessies en olywe: Appelkooscultivars. 1970. H.J. Walters

KWALITEITSTUDIES/QUALITY STUDIES

(S)WP.207: Kwaliteitstudies:
207/9: - Rypheidstandaarde en rypmaak van Bulida appelkose vir inmaakdoeleindes. 1976. T.R. Visagie

ONDERSTAMME/ROOTSTOCKS

(S)WP.251/10: Evaluering van ingevoerde en plaaslikgeselekteerde en -geteelde cultivars en onderstamme van bladwisselende vrugte en neute: Onderstamme vir appelkose. 1971. P.J.C. Stassen

PRODUKSIE/PRODUCTION

(A)T-Rp.163/3: Verhoging van die potensiaal van neut-, bessie- en ander minder belangrike sagtevrugsoorte in die somerreëngebied: Appelkose. 1976. T. Haulik

SIEKTES/DISEASES

(S)WP.257/1: Bogrondse swamsiektes van sagtevrugte, tafeldruiwe en ander toegegewe gewasse: Terugsterwing van appelkoosbome in Wes-Kaapland as gevolg van *Eutypa armeniacae*. 1976. A.C. Thomas

TEGNOLOGIE/TECHNOLOGY

*(S)WP.224: Verwerking van appelkose:

- *224/1: - Benutting van uitskot appelkose in moese en vrugtedranke. 1977. J.F. du T. Hugo

TELING/BREEDING

(A)T-Rp.163/3/1: Appelkose: Teling van seleksie van nuwe cultivars. 1976. T. Haulik

(S)WP.228: Teel van verbeterde appelkooscultivars:

- 228/1: - Teel van vroeë inmaakcultivars. 1977. N. Hurter, P.J.L. Ellis
- 228/2: - Teel van cultivars geskik vir droging. 1977. N. Hurter, P.J.L. Ellis
- 228/3: - Mutasieteelt. 1977. N. Hurter, P.J.L. Ellis

AVOKADO/AVOCADO

BEMESTING/FERTILIZERS

(S)N.109/1: Voedingsbehoeftes van die avokado: NPK-bemestingsproef - Burgershall. 1970. T.J. Koen, W. Langenegger

INSEKTEPLAE - BESTRYDING/INSECT PESTS - CONTROL

(S)N.130/1: Ontwikkeling van behandelings vir subtropiese vrugte wat voldoen aan kwarantynvereistes van ander lande: Uitvoer van avokado's. 1974. A. Schwartz, D.L. Milne

OPBERGING/STORAGE

(S)N.38: Koelopberging van avokado:

- 38/1: - Goedhouvermoë van avokado wat per boot na die buiteland verskeep word. 1962. D.H. Swarts

SIEKTES/DISEASES

(S)N.86: Avocado diseases:

- 86/3: - Virus diseases. 1968. J.V. da Graca, S.P. van Vuuren
- *86/4: - Control of storage diseases. 1971. D.H. Swarts
- 86/6: - Testing chemicals for the control of *Phytophthora cinnamomi*. 1971. R.T. Frean, R. Wood, J.N. Moll, R. Mataré
- 86/7: - Testing the resistance of avocado cultivars to *Phytophthora* root rot. 1971. R. Wood, R.T. Frean

VOORTPLANTING/PROPAGATION

(S)N.117:	Tuinboukundige aspekte van die avokado:
117/2:	- Vegetatiewe voortplanting. 1971. A.I.J. Bester
117/4:	- Abnormale entverbinding. 1972. A.I.J. Bester

BESSIEVRUGTE/BERRIES

TELING/BREEDING

*(S)WP.192:	Verbouing van brame en ander bessies:
*192/1:	- Teel van nuwe braamcultivars. 1971. W.G. Wenzel

DRUIF/GRAPE

AANPLANTING/PLANTING

(S)WI.45:	Plantwydtes en stelsels van oplei vir Suid-Afrikaanse wyndruifwingerde:

BEMESTING/FERTILIZERS

(S)WI.51:	Grond- en bemestingstudies met wyndruiwe:
51/1:	- NPK-bemestingsproef vir wingerd op droëland en onder besproeiing. 1964. D. Saayman
51/5:	- Bemestingsproef met 'n Fransdruifwingerd (Lutzville). 1973. D. Saayman, G.J.J. Alberts
51/6:	- Seisoensopname en verspreiding van tien voedingselemente by wingerdstokke gekweek in sandkultuur. 1974. W.J. Conradie
(S)WP.211/1:	Voeding van bladwisselende vrugte en bessies: Bemesting van tafeldruiwe deur drup- en minispuitbesproeiingstelsels. 1972. J.H. Terblanche

BESPROEIING/IRRIGATION

(S)WI.56:	Besproeiing- en vogstudies by wingerd vir wyn- en drogingsdoeleindes:
56/1(K):	- Waterbehoeftes van Steendruiwe op Clovelly gronde by Stellenbosch. 1973. J.L. van Zyl
56/2:	- Invloed van differensiële besproeiingskedules en -metodes op die prestasie van Colombard-druiwe (Robertson). 1975. J.L. van Zyl
56/6:	- Vergelykende evaluering van drup- en vloedbesproeiing op verskillende bosktok/onderstok cultivarkombinasies. 1977. J.L. van Zyl
(S)WP.254/2:	Water-, plant- en grondverhoudings: Lisimeterstudies oor besproeiingskedulering. 1974. F.C. van Rooyen

BEWERKING/CULTIVATION

(S)WI.49:	Studies oor die bewerking van wingerdgronde:
*49/1:	- Bewerking van 'n Clovelly grondvorm onder droëlandverbouing (Nietvoorbij). 1974. D. Saayman
49/2:	- Grondbewerkingstudies op Hutton grond in 'n besproeide Colombard wingerd (Lutzville). 1974. D. Saayman

BIOCHEMIESE STUDIES/BIOCHEMICAL STUDIES

(S)WP.147: Studies oor die rypwording en gepaardgaande metaboliese prosesse by tafeldruiwe:

CULTIVARS

(A)T-Rp.162/2: Tafeldruifproduksie in die somerreëngebied: Evaluasie van nuwe cultivars en teellyne in die verskillende produksiegebiede. 1975. E.P. Evans, P.M. Erasmus

(S)WI.43: Vergelykende evaluering van veredelde, nuutgeteelde of ingevoerde bostokcultivars:

43/1: - Visuele studies op kernaanplantings. 1964. W.J. Carstens

43/2: - Vergelyking van cultivars in veldproewe. 1964. W.J. Carstens

43/5: - Vergelyking van wyndruifcultivars in veldproewe op vier verskillende onderstokke op rivierslikgrond op Lutzville proefperseel No.101. 1970. W.J. Carstens

43/6: - Vergelyking van wyndruifcultivars in veldproewe op rooi sandgrond van die Olifantsriviergebied. (proefperseel Lutzville). 1972. W.J. Carstens

43/7(K): - Tussenplantingsproef met wit- en rooiwyndruifsoorte op Karoogrond by Vredendal. 1973. H.J. Schonken

43/8(K): - Tussenplantingsproef met witwyndruifsoorte op Dundee grond by Goudini (Rawsonville). 1973. G.G. v.d. Merwe, E. Archer

43/9(K): - Tussenplantingsproef met rooiwyndruifsoorte op Sterkspruit grondvorm in die Agter-Paarlgebied. 1973. E. Archer

43/10(K): - Tussenplantingsproef met witwyndruifsoorte op Hutton grond by Montagu. 1973. E. Archer

43/11: - Vergelyking van wyndruifcultivars op eie wortel in 'n veldproef op 'n Dundee grondtipe van die Oudtshoornproefplaas. 1974. W.J. Carstens

43/12(K): - Tussenplantingsproef met rooiwyndruifcultivars op 'n Clovelly grondvorm in Durbanville. 1974. E. Archer

43/13(K): - Tussenplantingsproef met witwyndruifcultivars op 'n Fernwood grondvorm in Noord-Agter-Paarl. 1974. E. Archer

43/14(K): - Tussenplantingsproef met rooiwyndruifcultivars op 'n Clovelly grondvorm in die Breërivierwyk. 1974. E. Archer

43/15(K): - Tussenplantingsproef met wit- en rooiwyndruifcultivars op 'n Hutton grondvorm by Klawer. 1974. E. Archer

43/16(K): - Tussenplantingsproef met rooiwyndruifsoorte op 'n Clovelly grondvorm in Malmesbury. 1974. E. Archer

43/17(K): - Tussenplantingsproef met witwyndruifcultivars op 'n Dundee grondvorm in Wolseley. 1974. E. Archer

43/18(K): - Tussenplantingsproef met witwyndruifcultivars op 'n Hutton grondvorm (Shorrocks) in Bonnievale. 1974. E. Archer

43/19(K): - Tussenplantingsproef met witwyndruifcultivars op 'n Dundee grondvorm op Ladismith 1974. E. Archer

43/20(K): - Tussenplantingsproef met rooiwyndruifcultivars op 'n Dundee grondvorm op Ladismith (A. van der W. Bester, Buffelsdrift). 1974. E. Archer

43/21(K): - Tussenplantingsproef met rooiwyndruifcultivars op 'n Hutton grondvorm (Shigalo) in die Klein Karoo (P. Terblanche, Rietvlei, De Rust). 1974. E. Archer

43/22(K): - Tussenplantingsproef met witwyndruifcultivars op 'n Dundee grondvorm in die Klein Karoo (B.D.L. Grundling, Sandkoppies, Wynandsrivier). E. Archer

43/23: - Evaluering van rooi- en witwyndruifcultivars op 'n Dundee grondtipe in die Laer-Oranjegebied by Upington. 1975. E. Archer

43/25(K): - Tussenplantingsproef met rooi wyndruifcultivars op 'n Huttongrondvorm in Darling. 1976. E. Archer

43/27(K): - Tussenplantingsproef met wit- en rooi wyndruifcultivars op 'n Huttongrondvorm in die Barkly-Wes omgewing. 1976. W.F. van der Westhuizen, C. Marincowitz

43/29: - Evaluering van bostokcultivars op die Vaalhartsnedersetting. 1973. W.F. van der Westhuizen

(S)WP.164: Seleksie van tafeldruifcultivars en -onderstokke:

*164/1: - Seleksie van Waltham Cross. 1966. G.J. le G. Smit

*164/2: - Seleksie van Barlinka. 1967. D.C. Uys

*164/3: - Seleksie van Alphonse Lavallêe. 1968. J.F.D. le Roux

*164/4: - Seleksie van Queen of the Vineyard. 1969. P.W. Smit

164/5: - Seleksie van New Cross. 1969. E.W. Mostert

164/6: - Seleksie van Almeria. 1969. E.W. Mostert

*164/7: - Seleksie van Salba. 1971. A.J. Hugo

164/8: - Seleksie van Golden Hill. 1973. J.F.D. le Roux

*(S)WP.200: Evaluering van tafeldruiwe:

*200/1: - Evaluering in die Hexvallei. 1971. D.C. Uys

*200/2: - Evaluering in die Citrusdalgebied. 1971. D.C. Uys

*200/3: - Evaluering in die Paarlgebied. 1971. D.C. Uys

ENOLOGIE/OENOLOGY

(S)WI.14: Bepaling van die kwaliteit van wyndruiwe:

14/4: - Stadium van optimum rypheid. 1966. C.S. du Plessis

(S)WI.20: Invloed van omgewingsfaktore op druif- en wyngehalte:

20/2: - Invloed van grondtipe op druif- en wyngehalte. 1973. P.H. Kleynhans

(S)WI.22: Uitskakeling van ongewenste giste, bakterieë en swamme in mos en wyn:

22/1: - Uitskakeling van mikroörganismes voor bottelering met behulp van kelderhigiëne. 1975. W.A. Agenbach

22/2: - Uitskakeling na bottelering met behulp van kaliumsorbaat. 1975. W.A. Agenbach

(S)WI.23: Invloed van druifhantering, pars- en kelderprosedure op druif- en wyngehalte:

23/6: - Invloed van verskillende grade van vrot op wyngehalte. 1974. G.W.W. Wagener

23/8: - Bepalingsmetodes en invloed van fenole op wyngehalte. 1974. A. Tromp

*23/10: - Ondersoek na faktore wat die wynkwaliteit van meganiesgeoeste druiwe beïnvloed. 1976. G.W. Wagener

23/11: - Ondersoek na verskillende metodes om goeie kwaliteit rooiwyne uit Cinsautdruiwe te berei. 1976. G.W. Wagener

(S)WI.24: Reukstowwe en verwante komponente van brandewyn, wyn en druiwe:

24/2: - Invloed van bepaalde hoër vetsuuresters op gehalte van wyn. 1973. J. Marais,

24/3: - Voorloperstowwe in druiwe van die etieloktoaat en etieldekanoaat esters in wyne. 1975. M.C. Houtman

(S)W.24/4:	- Skeiding van die mikrokomponente in wyngeur. 1975. W.A. Zeeman
(S)WI.28:	Identifisering van kwaliteitskomponente in wyn:
28/2:	- Evaluasie van die relatiewe bydraes van verskillende esters, hoër alkolhole en vetsure tot die geur van wyn. 1978. C.A. van der Merwe
(S)WI.30:	Veroudering van wyn:
30/1:	- Invloed van tyd, temperatuur en pH op sekere wynkomponente en wyngehalte. 1977. J. Marais
(S)WI.36:	Investigation of methods for decreasing sulphur dioxide in wines:
36/1:	- Effect of temperature on wine yeast fermentation and metabolism with special reference to sulphur dioxide-binding metabolites. 1975. J. Laszlo
36/2:	- Effect of dissolved oxygen and some antioxidative gases on SO_2 requirement of wines. 1976. J. Laszlo
(s)WI.37:	Verbetering van Suid-Afrikaanse wyngiste. 1975
37/1:	- Doeltreffende gebruik van gedroogde wyngis vir wynbereiding. 1975. W.A. Agenbach
(S)WI.38/3:	Chemiese beheer van bogrondse siektes van wingerd vir wyn en droogdoeleindes: Invloed van chemiese siektebeheermiddels op alkoholiese gisting en wynkwaliteit. 1976. W.A. Agenbach
(S)WI.57:	Korttermyn internasionale O.I.V. ondersoeke na die chemiese aspekte van die produkte van die wynstok. 1977. W. Zeeman
(S)WI.66:	Invloed van verskillende gistingstemperature op wyne van verskillende druifcultivars:
66/1:	- Invloed van gistingstemperatuur op tydsduur van gisting, wynkwaliteit en -karakter. 1978. C. Kok
(S)WI.69:	Ondersoek na appelmelksuurgisting in S.A. wyne:
69/1:	- Invloed van melksuurvormende bakerieë op die kwaliteit en samestelling van droë rooiwyn in Suid-Afrika. 1979. J.P. Snyman
(S)WP.29:	Druif- en kelderfaktore wat wynkwaliteitskomponente beïnvloed:
29/1:	- Faktore wat reproduseerbaarheid van wyngeurstofvorming en -gehalte bepaal. 1978. A.C. Houtman

FISIOLOGIE/PHYSIOLOGY

(S)WP.220:	Fisiologie van wortel- en kallusvorming by die wingerdstok. 1975. D.C. Uys
(S)WP.230:	Physiology of growth and development of table grapes:
230/1:	- Effect of virus infection on the rate of photosynthesis and respiration of table grape vines. 1977. Helga Tormann

GRONDVOORBEREIDING/SOIL PREPARATION

(S)WI.54:	Grondvoorbereidingstudies:
54/1:	- Invloed van grondvoorbereidingsdieptes en toevoegings van organiese materiaal op groei, produksie en kwaliteit van wyndruiwe. 1966. D. Saayman
54/2:	- Influence of soil preparation depths and additions of organic matter on growth production and quality of wine grapes (Robertson) 1976. D. Saayman
54/3:	- Invloed van grondvoorbereidingsmetodes en -dieptes asook bepaalde amelioranteop die grond en prestasie van wyndruiwe. 1977. L. van Huyssteen

INSEKTEPLAE/INSECT PESTS

(A)I-Pr.95:	Biologie en beheer van die wingerdfilloksera (*Dactylosphaera vitifolii*):
95/2:	- Bestandheid van sekere onderstokke teen filloksera. 1964. C.A. de Klerk
95/3:	- Chemiese beheer van filloksera. 1972. C.A. de Klerk, P.C. Smith
*(S)WI.39/1:	Biologie en beheer van die wingerd filloksera: Die bestandheid van onderstokke teen wingerd filloksera. 1964. C.A. de Klerk
(S)WI.39/3(K):	Chemiese beheer met hexachlorobutadieen in die Olifantsrivier-besproeiingsgebied. 1977. C.A. de Klerk
(S)WP.235/2:	Sagtevrugte: na-oesfitosanitêre beheermaatreëls vir plae: Kouesterilisasie van Barlinka met die Mediterreense vrugtevlieg. 1977. P.L. Swart
(S)WP.259:	Tafeldruiwe: Bionomie en ekologie van plae:
259/1:	- Uitwerking van plaagebeheermiddels op die ingevoerde witluis parasiet, *Anagyrus pseudococci*. 1978. E.A. de Kock

INSEKTEPLAE - BESTRYDING/INSECT PESTS - CONTROL

(A)I-Pr.127:	Morfologie, biologie en beheer van wingerd-margarodes (Margarodidae Morr. en Termitococcidae Jak.) in Suid-Afrika. 1975. C.A. de Klerk
(S)WP.156:	Biology and control of mealybugs in the Western and Southern Cape Province:
156/2:	- Chemical control of *Planococcus citri* on grapevines in the Hex River Valley. 1966. P.L. Swart, B.N. Barnes

KWALITEITSTUDIES/QUALITY STUDIES

(S)WI.42:	Optimale oesladings van wyndruifcultivars. 1976
(S)WP.207:	Kwaliteitstudies

MEGANIESE OES/MECHANICAL HARVESTING

(A)WI.23/9:	Invloed van druifhantering, pars- en kelderprosedure op druif- en wyngehalte: Evaluasie van meganiese oes van wyndruiwe. 1976. H.J. Snyders
(S)WI.45/7:	Plantwydtes en stelsels van oplei vir Suid-Afrikaanse wingerde: Ondersoek na oplei- en snoeipraktyke vir meganiese oes. 1976. A.S. Zeeman, H. Snyders

OES/HARVEST

(S)WI.42:	Optimale oesladings by wyndruifcultivars:
42/2:	- Optimale oeslading van 'n rooi- en 'n witdruifcultivar in die Stellenbosch-omgewing. 1977. J.H. van der Westhuizen

ONDERSTOKKE/ROOTSTOCKS

(S)WI.46:	Onderstokke vir Suid-Afrikaanse wingerde:
46/13:	- Siftingsproef met onderstokke vir sultanas te Upington. 1974. A. Calitz, W.J. Carstens
46/14:	- Vergelykende studie met verskillende onderstoksoorte, met Steen as bostok, op 'n Dundee grondtipe op die Oudtshoornse proefplaas. 1974. W.J. Carstens

(S)WI.46/15(K): - Vergelykende studie van verskillende onderstoksoorte met Steen as bostok op 'n Dundee grondtipe in die Montagugebied. 1974. W.J. Carstens, B.C.H. Rix

46/16: - Affiniteitsproef met nuwe onderstokcultivars. 1975. A.H. Bergh, P.G. de Bruyn

46/17: - Vergelykende studie met verskillende onderstoksoorte met Clairette blanche as bostok op 'n Hutton-grondvorm. 1973. W.F. van der Westhuizen

46/18: - Invloed van grondsuurheid op die prestasie van verskillende onderstokke. 1976. W.J. Conradie

*(S)WP.188: Onderstokke vir tafeldruiwe:

*188/1: - Onderstokke vir die cultivar Barlinka in die Hexvallei. 1972. E.W. Mostert

*188/2: - Onderstokke vir die Paarlgebied. 1972. D.C. Uys

ONKRUIDBESTRYDING/WEED CONTROL

(S)WI.50/1: Chemiese onkruidbeheer in wyndruifwingerde: Fitotoksisiteit van onkruiddoders vir sekere druifcultivars. 1974. C.J. Smit

50/2: - Doeltreffendheid van onkruiddoders. 1977. C.J. Smit

OPBERGING/STORAGE

*(S)WP.207/10: Influence of different pre-cooling treatments on grape quality. 1975. L. Ginsburg

207/11: - Kwaliteitstudies: Voorverkoeling en opberging van tafeldruiwe verpak in poli-etileensakke. 1977. J.C. Combrink, J. László

(S)WP.248: Tafeldruiwe: Invloed van vooroes- en voorverkoelingsfaktore op houvermoë:

248/2: - Opberging in verseëlde en geventileerde poliëtileenvoerings. 1978. J.C. Combrink

248/3: - Invloed van verkoelingstempo's op kwaliteit van druiwe verpak in poliëtileensakke. 1978. J.C. Combrink

OPLEISTELSELS/TRELLISING

(S)WI.45/5: Plantwydtes en stelsels van oplei vir Suid-Afrikaanse wyndruifwingerde: Sultanas en wyndruiwe in die Laer Oranjerivierstreek (Upington). 1970. A.S. Zeeman, A. Calitz

(S)WI.56/4: Besproeiing- en vogstudies van wingerd vir wynmaak- en droogdoeleindes: Invloed van opleistelsels en gepaardgaande mikroklimaat op die waterverbruik van 'n Chenin blanc wingerd. 1977. J.L. van Zyl

SIEKTES/DISEASES

(A)PS-Pr.38: Viruses and virus diseases of the grapevine:

38/1: - Detection and identification of viruses in the grapevine. 1970. D.J. Engelbrecht

38/2: - Elimination of viruses in the grapevine. 1970. D.J. Engelbrecht

(S)WI.33: Cultivarbestandheid teen bogrondse siektes van wingerd vir wyn en droogdoeleindes:

33/1: - Vinnige evaluasie van cultivarbestandheid teen nie-verpligte patogeen-botrytis. 1976. H.S. van der Walt

33/2: - Vinnige evaluasie van cultivarbestandheid teen verpligte patogeen-oïddium. 1976. H.S. van der Walt.

(S)WI.34: Ondergrondse swam- en bakteriesiektes by wyndruifwingerde:

34/1: - Opname van wortelpatogene in wingerde en wingerdkwekerye. 1974. P.G. Marais

(S)WI.34/2: - Bepaling van die weerstandbiedendheid van wingerdonderstokke teen *Phytophthora*-wortelverrotting deur middel van potproewe. 1974. P.G. Marais, H.S. van der Walt

34/3: - Bepaling van die weerstandbiedendheid van wingerdonderstokke teen *Phytopthora*-wortelverrotting in veldproewe. 1975. P.G. Marais

34/4: - Ondergrondse swam- en bakteriesiektes van wyndruifwingerde: Beheer van *Phytophtora* spp. in kwekerystokke en -gronde. 1977. P.G. Marais

(S)WI.35: Ondersoek na die oorsake van en beheermaatreëls teen groeistilstandsiekte by sultanas:

35/1: - Invloed van kaliumtoedienings, besproeiingsbehandelings en drag op die voorkoms van groeistilstandsiekte. 1973. D. Saayman

35/2: - Bestudering van voedingstofopname en -translokasie deur middel van orgaananalise. 1973. D. Saayman

35/5: - Invloed van bo- en ondergrondse temperature op die ontwikkeling van *Vitis* cultivars onder beheerde toestande. 1976. L.J. Jooste

(S)WI.38: Chemiese beheer van bogrondse siektes van wingerd vir wyn- en droogdoeleindes:

38/1: - Gesamentlike chemiese beheer van ekonomies belangrike bogrondse swamsiektes in die Boland kusgebied. 1976. P.G. Marais

38/2: - Gesamentlike chemiese beheer van ekonomies belangrike bogrondse swamsiektes in die Oranjeriviergebied. 1976. P.G. Marais

(S)WI.59: Vestiging en vernuwing van wingerd:

59/1: - Vernuwing van 'n ou Cabernet wingerd. 1977. J. van Rensburg

(S)WP.203: Bakteriese siektes van sagtevrugte en tafeldruiwe:

203/3: - Bestudering van *Xanthomonas amperlina*, die oorsaaklike organisme van vlamsiekte by wingerd. 1972. J. Roberts

(S)WP.258: Tafeldruiwe: Chemiese en fisiese beheer van bakteriese, swam- en virussiektes in wingerde:

258/1: - Beheer van bederf veroorsaak deur *Botrytis cinereal.* 1972. F.N. Matthee, A.C. Thomas

SKADELIKE DIERE - AALWURMS/HARMFUL ANIMALS - EELWORMS

(A)I-Pr.96: Nematodes in South African vineyards:

96/3: - Response of established vineyards to nematicide treatment. 1972. P.C. Smith

96/4: - Transmission of grapevine virus diseases by nematode vectors. 1975. P.C. Smith

SNOEI/PRUNING

(S)WI.67: Invloed van winter- en somersnoei op stokprestasie. 1978

67/1: - Snoeimetodes vir Cabernet Savignon. 1978. D.C. Morkel

TELING/BREEDING

(A)T-Rp.162: Tafeldruifproduksie in die somerreëngebied:

162/1: - Teling en seleksie van verbeterde cultivars. 1975. E.P. Evans

(S)WP.231: Tafeldruiwe: Teel van verbeterde cultivars

231/1: - Teel van 'n laat wit cultivar. 1977. N. Hurter, P.J.L. Ellis

231/2: - Teel van vroeë swart en wit tafeldruifcultivars. 1977. N. Hurter, P.J.L. Ellis

(S)WP.231/3: - Teel van een of meer nuwe pitlose cultivars. 1977. N. Hurter, P.J.L. Ellis

*(S)WP-BD.59/2: Teling van nuwe tafeldruifcultivars: Konvensionele teelverbeteringop die diploïede vlak. 1966. P.J.L. Ellis, N. Hurter

VERBOUINGSPRAKTYKE/CULTIVATION PRACTICES

(S)WI.47/3: Waterhuishouding en besproeiingsbehoeftes van wyndruiwe:

  47/3: - Vogbewaring deur middel van 'n plastiekfilm op die grond en wasbedekking van stokke by die vestiging van wingerd. 1972. J.H. van der Westhuizen

(S)WP.242: Allerlei sagte- en bessievrugte: Verbouing in die winterreënvalgebied. 1978. (Sien ook Kersies en Amandels)

*(S)WP-BD.58/5: Beheer van die verhouding van vegetatiewe groei tot drag van tafeldruiwe: Invloed van die aantal trosse per stok op die gehalte en rypwording van Alphonse Lavallée-druiwe, sowel as die groeikrag van die stokke. 1971. G.J. le G. Smit

VOORTPLANTING/PROPAGATION

(S)WI.41: Verbetering van voortplantingsmateriaal vir Suid-Afrikaanse wingerde:

  41/2: - Gebruik van kloneseleksie. 1965. W.J. Carstens

  41/3: - Importation, propagation and investigation of new cultivars and clones. 1965. W.J. Carstens

  41/4: - Tweedefase klone-evaluering van Colombar te Lutzville. 1974. W.J. Carstens

  41/5: - Tweedefase klone-evaluering van Hanepoot te Lutzville. 1974. W.J. Carstens

  41/6: - Tweedefase evaluering van Steenklone te Nietvoorbij, Stellenbosch. 1974. W.J. Carstens

(S)WI.44: Verbetering van ent- en kwekerypraktyke:

  44/4: - Uittoets van doeltreffende enttegnieke. 1972. J.H. van der Westhuizen

  44/5: - Produksie van geënte stokke in kartonhouers - 'cartonage'. 1972. J.H. van der Westhuizen

WYNGEHALTE/WINE QUALITY

(S)WI.28/1: Identifisering van kwaliteitskomponente in wyn: Siftingsproef vir die identifikasie van kwaliteitsfaktore in Chenin blanc druiwe. 1977. A.C. Houtman

GRENADELLA/GRANADILLA

BEMESTING/FERTILIZERS

(S)N.129: Voedingsbehoeftes van die grenadella:

  129/1: - Bemestingsproef en blaarontledingsopname. 1973. T.J. Koen, G. Smart

CULTIVARS

(S)N.88: Introduction of new granadilla species:

  88/1: - Preliminary studies on suitability for fresh fruit and processing purposes. 1973. F.A. Kuhne

SIEKTES/DISEASES

(S)N.136: Virus diseases of citrus and subtropical fruit:

- 136/1: - 'Woodiness' disease of granadillas. 1974. J.V. da Graca

VERBOUING/CULTIVATION

(S)N.119: Increasing the lifespan of granadillas:

- *119/3: - Effect of shading, mulching and irrigation practices on granadillas. 1973. D.L. Milne, G.S. Bredell, F.A. Kuhne

*(S)WP.214: Planttyd en plant- en opleistelsels vir grenadellas. 1972. C.W.J. Bester

KERNVRUGTE/POME FRUIT

BIOCHEMIE/BIOCHEMISTRY

(S)WP.232: Kernvrugte: Voor- en na-oes vrugfisiologie. 1977

CULTIVARS

(S)WP.249: Kernvrugte: Evaluasie van cultivars, seleksies en onderstamme. 1978

OPBERGING/STORAGE

(S)WP.247: Kernvrugte: Invloed van vooroes- en voorverkoelingsfaktore op houvermoë. 1978

PRODUKSIE/PRODUCTION

(S)WP.250: Kernvrugte: Produksiesisteme en oesbeheer. 1978

SIEKTES/DISEASES

(S)WP.256: Kernvrugte: Etiologie en epidemiologie van bakteriese swam- en virussiektes in boorde. 1978

KERSIE/CHERRY

CULTIVARS

(A)T-Rp.164/2: Kersieproduksie in die somerreëngebied: Evaluasie van kersiecultivars. 1975. K.G. Zwahlen

- 164/2/1: - Evaluering van kersie-onderstamcultivars. 1975. K.G. Zwahlen
- 164/2/2: - Evaluasie van soetkersiecultivars. 1975. K.G. Zwahlen

(S)WP.242/4: Allerlei sagte- en bessievrugte: Evaluasie van kersiecultivars in Wes-Kaapland en Langkloof. 1977. P.R. Jolly

VERBOUINGSPRAKTYKE/CULTIVATION PRACTICES

(A)T-Rp.164/1: Kersieproduksie in die somerreëngebied: Verbouingstudies. 1975. K.G. Zwahlen

(S)WP.242: Allerlei sagte- en bessievrugte: Verbouing in die winterreënvalgebied. 1978. (Sien ook Bessievrugte en Neute: Amandels)

VOORTPLANTING/PROPAGATION

(A)T-Rp.164/1/1: Kersieproduksie in die somerreëngebied: Verbouingstudies: Voortplantingstudies. 1975. K.G. Zwahlen

KIWIBESSIE/KIWI FRUIT

VERBOUING/CULTIVATION

(S)WP.222: Kiwibessies in Wes-Kaapland:

222/1: - Evaluering van Kiwibessiecultivars onderstamme en kruisbestuiwers. 1977. D.C. Bosman

KOEJAWEL/GUAVA

CULTIVARS

(S)N.113: Guava studies:

113/1: - Guava selections. 1970. L.C. Bolt

PRODUKSIE/PRODUCTION

(S)N.113/2: Koejawelstudies:Verskillende tye van snoei. 1975. J.J. Kruger

113/3: - Verskillende snoeistelsels. 1975. J.J. Kruger

LIETSJIE/LITCHI

BEMESTING/FERTILIZERS

(S)N.100/1: Voedingsbehoeftes van die lietsjie: Reaksie van die lietsjie op N-, P- en K-toedienings ten opsigte van oes en blaarsamestelling. 1968. T.J. Koen, W. Langenegger

OPBERGING/STORAGE

(S)N.39: Na-oeshantering van lietsjies:

39/1: - Beheer van skimmelgroei. 1969. D.H. Swarts

PRODUKSIE/PRODUCTION

(S)N.92: Litchi studies:

92/2: - Comparison between grafted and airlayer litchi trees. 1968. A.J. Joubert

MANGO

BEMESTING/FERTILIZERS

(S)N.126: Voedingsbehoeftes van die mango:

126/1: - NPK-bemestingsproef in die Komatipoortgebied. 1972. S.F. du Plessis, G. Smart

CULTIVARS

(S)N.110: Mangostudies:

110/2: - Seleksie en uittoets van nuwe cultivars. 1971. J.H.E. Smith

INSEKTEPLAE/INSECT PESTS

(S)N.91: Mangosnuitkewerstudies:

91/1: - Lewensgewoontes en bestryding van die mangosnuitkewer. 1969. I.B. Kok, D.L. Milne

PRODUKSIE/PRODUCTION

(S)N.110: Mangostudies:

110/1: - Snoei van groot volwasse mangobome om produksie en vrugkwaliteit te verbeter. 1970. J.H.E. Smith

110/3: - Fisiologiese ondersoek na vrugvorming. 1972. L.J. van Lelyveld

SIEKTES/DISEASES

(S)N.118: Mango diseases:

118/1: - Control of bacterial spot disease on mangoes caused by *Erwinia mangiferae* 1970. R. Wood

118/2: - Control of storage diseases. 1971. D.H.Swarts

PAPAJA/PAPAYA

OPBERING/STORAGE

(S)N.116: Post-harvest studies on papaya:

116/1: - Control of storage diseases affecting papayas. 1970. D.H. Swarts

TELING/BREEDING

(S)N.142: Tuinboukundige aspekte van die papaja:

142/1: - Uittoets teel en verbetering van bestaande en nuwe papaja teellyne. 1978. J.C. Botha

PEER/PEAR

CULTIVARS

(S)WP.166: Evaluering van ingevoerde en plaaslikgeselekteerde en geteelde cultivars en onderstamme van bladwisselende vrugte en neute:

166/4: - Peeronderstamme. 1971. H.J. van Zyl

166/12: - Peercultivars en -seleksies. 1971. J.V. Hadlow, J.D. Stadler

(S)WP.178/2: Aanplanting en instandhouding van bestaande en nuwe cultivars en onderstamme van kern- en steenvrugte, neute, bessies en olywe: Peercultivars. 1970. J.W. Etsebeth

OESBEHEER/CROP CONTROL

(S)WP.168: Oesbeheer by bladwisselende vrugtebome:

(S)WP.168/16: - Vergelyking van die piramied-, palmet- en kelkopleistelsels by verskillende plantafstande vir Packham's Triumph, Doyenne du Comice en Bon Chrétien op kweper A onderstamme. 1974. H.J. van Zyl

168/17: - Vrugsetstudies met Packham's Triumph pere. 1974. H.J. van Zyl

168/18: - Verhoging van produksie. 1977. H.J. van Zyl

TELING/BREEDING

(S)WP.226: Teel van verbeterde peercultivars:

226/1: - Teel van laat cultivars wat vroeg in drag kom. 1977. N. Hurter, P.F. Louw

226/2: - Teel van cultivars wat teen skurfsiekte bestand is. 1977. N. Hurter, P.F. Louw

226/3: - Teel van Packham's Triumph tipe met 'n kompakte groeiwyse. 1977. N. Hurter, P.F. Louw

PERSKE/PEACH

BESPROEIING/IRRIGATION

(A)T-Rp.161/3/1: Verbouingstudies: Besproeiingsbehoeftes van perskes. 1975. T. Haulik, E.P. Evans

BIOCHEMIESE STUDIES/BIOCHEMICAL STUDIES

(S)WP.175/4: Seisoensopname van voedingstowwe deur sagtevrugtebome en bessies: Seisoensopname van voedingstowwe en die seisoenspatroon vir die opbouing, opberging, mobilisasie en verbruik van die koolhidraat- en stikstoffraksies by twee-jaar-oue Kakamas perskebome gekweek in sandkultuur. 1974. P.J.C. Stassen

CULTIVARS

(A)T-Rp.161: Perskeproduksie in die somerreëngebied:

161/2: - Evaluasie van perskecultivars en teellyne in die verskillende produksiegebiede. 1975. E.P. Evans, T. Haulik,0006K.G. Zwahlen

161/2/1: - Dessertperskes. 1975. E.P. Evans, K.G. Zwahlen, M.J. Slabbert

161/2/2: - Perskes vir prosessering (inmaak en droging). 1975. E.P. Evans, K.G. Zwahlen, M.J. Slabbert

(S)WP.166: Evaluering van ingevoerde en plaaslikgeselekteerde en -geteelde cultivars en onderstamme van bladwisselende vrugte en neute:

166/5: - Evaluering van onderstamme vir perskes. 1971. O. Bergh

166/8: - Perskecultivars en -seleksies. 1971. J.D. Stadler

(S)WP.178/3: Aanplanting en instandhouding van bestaande en nuwe cultivars en onderstamme van kern- en steenvrugte, neute, bessies en olywe: Perskecultivars. 1970. J.W. Etsebeth

INSEKTEPLAE/INSECT PESTS

(S)WP.233/1: Stone fruits: Bionomics and ecology of pests: Development of a monitoring system for false codling moth populations in peach orchards. 1977. T.L. Blomefield, K.L. Pringle

OESBEHEER/CROP CONTROL

(S)WP.168/11: Oesbeheer by bladwisselende vrugtebome: Snoei van Kakamastipe perskebome vir die verkryging van kleiner bome, 'n vroeër drag en langer produktiewe leeftyd. 1972. O. Bergh

PLAAGBEHEER/PEST CONTROL

(A)T-Rp.161/4: Verhoging van die potensiaal van perskeproduksie in die somerreëngebied: Plaagbeheerstudies. 1976. C.C. Daiber

161/4/1: - Die biologie van en 'n ekologiese opname van volskodlingmot in perskeboorde. 1975. C.C. Daiber

TEGNOLOGY/TECHNOLOGY

*(S)WP.174/8: Inmaak van vrugte en groente: Bepaling van rypheid van taaipitperskes vir inmaak. 1977. J.D.C. Theron, B.K. Nortje

(S)WP.237/3: Steenvrugte: Verwerking: Droging van Elberta perskes. 1978. G.L. Wium

TELING/BREEDING

(A)T-Rp.161/1: Perskeproduksie in die somerreëngebied: Teling en seleksie. 1975. P.M. Erasmus, M.J. Slabbert

(S)WP.186: Teling van nuwe perskecultivars:
186/1: - Teling van nuwe inmaak perskecultivars. 1971. W.G. Wenzel

186/2: - Teling van nuwe geelvleiscultivars vir dessert- en droogdoeleindes. 1971. W.G. Wenzel

VERBOUING/CULTIVATION

(A)T-Rp.161/3: Verhoging van die potensiaal van perskeproduksie in die somerreëngebied: Verbouingstudies. 1976. T. Haulik,

PIESANG/BANANA

BEMESTING/FERTILIZERS

(S)N.111: Voedingsbehoeftes van die piesang:

111/1: - Plantontwikkeling en blaarsamestelling. 1970. S.F. du Plessis, P.C. van Zyl

111/3: - Landswye ondersoek om die verwantskap tussen plantsamestelling en opbrengs te bepaal. 1970. P.C. van Zyl

CULTIVARS

(S)N.102: Evaluation of promising Cavendish banana selections:

102/1: - Preliminary selection. 1968. F.A. Kuhne

OESTYDREGULERING/CROP TIMING

(S)N.70: Crop timing of bananas:

70/2: - Importance of different types of planting material at various times of planting. 1968. F.A. Kuhne

PRODUKSIE/PRODUCTION

(S)N.101: Phenological study of the banana plant:

- 101/1: - Studies on leaf emergence, sucker growth, flower initiation and fruiting cycle. 1968. F.A. Kuhne, S.J. Bozalek

SIEKTES/DISEASES

(S)N.139: Banana diseases:

- 139/1: - Panama Wilt Disease. 1977. B.Q. Manicom

SKADELIKE DIERE - AALWURMS/HARMFUL ANIMALS - EELWORMS

(S)N.81: Eelworm studies:

- 81/11: - Banana eelworms. 1976. R.K. Jones, E.A. de Villiers

TEGNOLOGIE/TECHNOLOGY

(S)N.135: Na-oeshantering van subtropiese vrugte:

- 135/1: - Na-oeshantering van piesangs. 1975. D.H. Swarts

PRUIM/PLUM

BIOCHEMIE/BIOCHEMISTRY

(S)WP.197: Studies oor rypwording by sagtevrugte en tafeldruiwe:

- 197/1: - Metodes om rypheidsgraad van pruime te bepaal. 1971. H. Tormann

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(S)WP.166/17: Evaluering van ingevoerde en plaaslikgeselekteerde en -geteelde cultivars en onderstamme van bladwisselende vrugte en neute: Pruimcultivars en seleksies. 1971. J.D. Stadler

(S)WP.178/5: Aanplanting en instandhouding van bestaande en nuwe cultivars en onderstamme van kern- en steenvrugte, neute, bessies en olywe: Pruim- en pruimedantcultivars. 1970. J.W. Etsebeth

ONDERSTAMME/ROOTSTOCKS

(S)WP.166/9: Evaluering van ingevoerde en plaaslikgeselekteerde en -geteelde cultivars en onderstamme van bladwisselende vrugte en neute: Onderstamme vir pruime. 1971. P.C.J. Stassen, H.J. van Zyl

TELING/BREEDING

(S)WP.158: Breeding new plum cultivars:

- 158/2: - Breeding research at the polyploid level. 1965. N. Hurter
- 158/3: - Mutation breeding. 1965. N. Hurter
- 158/4: - Teling vir bestandheid teen bakteriese vlek (*Xanthomonas pruni*). 1972. M.J. van Tonder

(S)WP.162/3: Breeding new plum rootstock types: Assessment of rootstocks. 1965. N. Hurter

VERBOUINGSPRAKTYKE/CULTIVATION PRACTICES

(S)WP.168: Oesbeheer by bladwisselende vrugtebome:

168/15: - Vergelyking van die palmet- en kelkvorm van oplei vir Santa Rosa, Gaviota, Kelsey en Songold pruimcultivars. 1973. O. Bergh

PYNAPPEL/PINEAPPLE

BEMESTING/FERTILIZERS

(S)N-OL.12: Bemestingsproewe met pynappels (*Ananas comosus*):

12/3: - Blaarmonsternemingstegnieke en blaarontledingsopname. 1972. S.F. du Plessis, E.R. Dalldorf

12/4: - Makro-elementbemesting. 1972 W. Langenegger, D.B. Dalldorf

DEKLAE/MULCHING

(S)N.143: Mulching of pineapples:

143/1: - Evaluation of various mulching practices. 1978. D.P. Keetch

INSEKTEPLAE - BESTRYDING/INSECT PESTS - CONTROL

(S)N.133: Arthropod pineapple pests:

133/2: - Fruit and foliar pests. 1974. G.J. Petty

133/3: - Soil pests. 1974. G.J. Petty

ONKRUIDBESTRYDING/WEED CONTROL

(S)N-OL.1: Onkruidbeheer by pynappels (*Ananas comosus*):

PRODUKSIE/PRODUCTION

(S)N.134: Phenological studies of the pineapple plant:

134/1: - Study of the natural growth cycle. 1974. D.P. Keetch, S.J. Bozalek

SIEKTES/DISEASES

(S)N-OL.8/7: Control of disease in pineapples (*Ananas comosus*): Incidence, geographic distribution and seasonal occurrence of abnormalities and diseases. 1974. D.P. Keetch

SKADELIKE DIERE - AALWURMS/HARMFUL ANIMALS - EELWORMS

(S)N.81/9: Eelworm studies: Incidence and control of nematodes on pineapples. 1971. D.L. Milne, D.P. Keetch

SPASÏERING/ESPACEMENT

(S)WP.144: Plant espacement in pineapples:

144/1: - Optimum plant espacement for pineapples in South Africa. 1977. E.R. Dalldorf

TELING/BREEDING

(S)N-OL.5: Veredeling van die pynappel (*Ananas comosus*):

5/1: - Seleksie as telingsmedium by die pynappel. 1967. E.R. Dalldorf, G.S. Webster

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(S)N-OL.10: Use of synthetic hormones on pineapples (*Ananas comosus*):

10/4: - Evaluation of the effectiveness of various forcing agents. 1970. E.R. Dalldorf, G.S. Webster

SITRUS/CITRUS

BEMESTING/FERTILIZERS

(S)N.114: Voedingsbehoefte van sitrus:

114/3: - Bemesting in die Citrusdal gebied. 1971. S.F. du Plessis, G. Smart

114/4: - Geskiktheid van verskillende magnesiumbronne. 1974. S.F. du Plessis, G. Smart

114/5: - Suurlemoene: Bepaling van blaarsamestellingsnorme vir optimum produksie. 1977. S.F. du Plessis, T.J. Koen, G. Smart

114/6: - Kaliumproef op probleemgronde. 1977. S.F. du Plessis, G. Smart

CULTIVARS

(S)N.1: Sitrusonderstamstudies:

*1/3: - *Citrus reticulata* (nartjie) en ander sitrussoorte as onderstamme vir Greathead en Palmer nusellêre nawels (Nelspruit). 1957. P.J. Müller

1/7: - Growweskil suurlemoenseleksies as onderstam vir sitrus. 1968. P.J. Müller

1/8: - Onderstamme vir Olinda nusellêre Valencia en Palmer nusellêre nawels in Oos-Transvaal, Oos-Kaap en Wes-Kaap. 1969. P.J. Müller, W.J. Bruwer

1/9: - Onderstamme vir pomelocultivars in die Makatinivlaktegebied en die Oos-Kaap. 1969. P.J. Müller, W.J. Joubert

1/10: - Bestandheid teen *Tristeza*-virus van verskillende Bitter Seville seleksies as onderstam vir soetlemoen. 1969. J.N. Moll, T.N.Trench

1/11: - Waardebepaling van genera verwant aan *Citrus* en *Poncirus*. 1970. J.H. de Lange, J.N. Moll

1/13: - Evalueringstegnieke vir sitrusonderstamme m.b.t. brakverdraagsaamheid. 1978. P.J.L. Grobler

(S)N.2: Sitrusbostamstudies:

2/9: - Produksie van virusvry nusellêre sitrus moedermateriaal. 1968. G.S. Bredell

*2/10: - Veselsterkte van sitrusvrugte. 1971. P.J.L. Grobler

2/12: - Prestasie van plaaslike sowel as ingevoerde sitrussoorte, cultivars, seleksies en verwante soorte. 1972. W.A. Eshuys

2/13: - Reaksie van 'n reeks bostam-onderstam kombinasies van sitrus en verwante soorte. 1972. W.A. Eshuys

(S)N.2/14: - Waardebepaling van nartjies en nartjiekruisings. 1972. J.H. de Lange

2/15: - Bestuiwingsbehoeftes. 1971. J.H. de Lange

2/16: - Reaksie van ses Valencia-seleksies in vier verskillende gebiede. 1974. W.P. Burger

2/17: - Reaksie van vyf nawelseleksies in drie verskillende gebiede. 1974. P.J. Müller, W.J. Bruwer

2/18: - Reaksie van sewe pomeloseleksies in vier verskillende gebiede. 1972. P.J. Müller, W.J. Bruwer

2/19: - Reaksie van vyf suurlemoenseleksies in drie verskillende gebiede. 1973. P.J. Müller, W.P. Burger

2/21: - Midseisoen cultivars. 1976. P.J. Müller, W.J. Bruwer

2/22: - Sitrusbostamstudies: Rooi pomeloseleksie, evaluering. 1977. P.J. Müller

2/23: - Vroeë en laat nawelseleksies, evaluering. 1977. P.J. Müller, W.J. Bruwer

*(S)WP.196/3: Verwerking van sitrusvrugte: Evaluering van lemoencultivars vir sapbereiding. 1972. C.F. Hansmann

EVAPOTRANSPIRASIESTUDIES/EVAPOTRANSPIRATION STUDIES

(S)N.103/1: Besproeiing van sitrusboorde onder Oos-Kaapse toestande: Bepaling van evapotranspirasie en grondvog in sitrusboorde. 1968. G.C. Green

HERPLANTING/REPLANTING

(S)N.82: Herplanting van sitrus:

*82/4: - Invloed van grondsteriliseerders en grondherwinningsmaatreëls op die groei van sitrusbome op ou sitrusgrond - Addo. 1969. W.P. Burger

82/5: - Invloed van grondsteriliseerders en grondherwinningsmaatreëls op die groei van sitrusbome op ou sitrusgrond - Zebediela. W.P. Burger

82/6: - Reaksie van verskillende onderstamme op braksoute en wortelparasiete. 1971. W.P. Burger

82/8: - Invloed van verskillende onderstam-bostamkombinasies op die groei van die daaropvolgende kombinasies. 1971. W.P. Burger

82/9: - Invloed van grondberoking en diepploeg op die groei van vier onderstamme op ou sitrusgrond. 1972. W.P. Burger

INSEKTEPLAE/INSECT PESTS

(S)N.7: Bionomie en bestryding van myte belangrik by sitrusverbouing:

*7/2: - Bionomie en bestryding van die sitrusknopmyt op nawels. 1965. A. Schwartz

*7/3: - Bevolkingsdinamika van sitrusmyte. 1967. A. Schwartz

(S)N.17: Dopluisbestryding op sitrus met oliespuitmiddels en organiese insektemiddels. 1934. W.J. du Toit

(S)N.93: Studies on spoilage in citrus fruits:

93/1: - Control of false codling moth in export citrus by means of fumigants. 1968. A. Schwartz

93/2: - Fruit fly control investigation on citrus. 1955. I.B. Kok

INSEKTEPLAE - BIOLOGIESE BEHEER/ INSECT PESTS - BIOLOGICAL CONTROL

(S)N.78: Integration of biological and chemical control of citrus pests:

- 78/1: - Control of red scale, *Aonidiella aurantii*. 1964. E.C.G. Bedford
- 78/2: - Control of the circular purple scale, *Chrysomphalus ficus*. 1964. E.C.G. Bedford
- 78/6: - Integrated control of red scale, *Aonidiella aurantii*, in the Transvaal Lowveld. 1967. E.C.G. Bedford
- 78/7: - Study of the South African citrus thrips, *Scirtothrips aurantii*. 1969. E.C.G. Bedford, D.L. Milne

KOELOPBERGING/COLD STORAGE

*(S)N.24/8: Koelopberging van sitrus: Ondersoek na die voorkoms van gepokte skil. 1974. S.F. du Plessis.

ONKRUIDBESTRYDING/WEED CONTROL

(S)N.84: Bewerking van sitrusboorde:

- 84/1: - Chemiese onkruidbeheer in sitrusboorde. 1967. A.P. Vincent

SIEKTES/DISEASES

(S)N.62: Histochemical indexing methods for citrus virus diseases. 1961. J.V. da Graca, J.N. Moll, S.P. van Vuuren

(S)N.140/1: Tristeza virus complex: Tristeza investigations in citrus on the Messina experiment farm. 1976. Thelma N. Trench

- 140/3: - Mild strain protection of grapefruit and limes against tristeza stem pitting. 1976. Thelma N. Trench

SIEKTES - VERGROENING/DISEASES - GREENING

(S)N.120: Mycoplasma in citrus and subtropical fruit trees:

- 120/1: - Isolation and culturing of greening mycoplasma. 1971. J.N. Moll
- 120/2: - Pathogenicity of mycoplasma in greening. 1971. J.N. Moll
- 120/3: - Control of greening mycoplasma. 1971. J.N. Moll, J.V. de Graca, S.P. van Vuuren

SKADELIKE DIERE - AALWURMS/HARMFUL ANIMALS - EELWORMS

(S)N.81/8: Eelworm studies: Citrus eelworm control. 1971. D.L. Milne, A.E. de Villiers

TEGNOLOGIE/TECHNOLOGY

(S)WP.196: Verwerking van sitrusvrugte:

- *196/2: - Bepaling van die hoeveelheid lemoensap in vrugtedranke. 1971. C.F. Hansmann

TELING/BREEDING

(S)N.1/12: Sitrusonderstamstudies: Teling. 1970. J.H. de Lange, J.N. Moll

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(S)N.2/20: Sitrusbostamstudies: Teling. 1974. J.H. de Lange

VERBOUING/CULTIVATION

(S)N.123: Plantafstande van sitrus:

123/1: - Oplei en heiningsnoei van sitrusbome. 1972. W.A. Eshuys

(S)N.125: Sitruskwekerypraktyke:

*125/3: - Invloed van grondberokingsmiddels op sitrussaadontkieming en saailinggroei. 1972. P.J. Müller

VRUGSETTING/FRUIT-SET

*(S)N.108/1: Vrugset van die nawel soetlemoen: Hormoonstudies. 1970. J.H. de Lange

STEENVRUGTE/STONE FRUIT

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(S)WP.251: Steenvrugte: Evaluasie van cultivars, seleksies en onderstamme. 1978

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(S)WP.252: Steenvrugte: Produksiesisteme en oesbeheer. 1978

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(S)WP.257: Steenvrugte: Etiologie en epidemiologie van bakteriese, swam- en virussiektes in boorde. 1978

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(S)WP.166/19: Evaluering van ingevoerde en plaaslikegeselekteerde en -geteelde cultivars en onderstamme van bladwisselende vrugte en neute: Evaluering van vyecultivars. 1974. E.J. van Zyl

Weiding/Pastures

AANGEPLANTE WEIDINGS/CULTIVATED PASTURES

BEMESTING/FERTILIZERS

N-Ce.108/7: Pasture production studies in the Umgeni catchment: Reaction of grass/legume pasture to levels of phosphorus and lime. 1977. P.E. Bartholomew, C.I. McDonald

108/8: - Reaction of white clover to levels of phosphorus and lime. 1977. P.E. Bartholomew

N-Ce.132/3: Evaluation of *Cynodon dactylon* cv Coastcross II in the Eastern Grassveld: Effect of various levels of N, P and K on grass productivity at Cedara. 1974. P.E. Bartholomew, J.W. Cross, C.I. MacDonald

N-Dd.6/3:	Cultivated pastures in the Sandy Sourveld of Natal: Phosphate and potash requirements of *Eragrostis curvula* grown on a member of the Leksand soil series. 1971. P.E. Bartholomew, M.P.W. Farina
N-Ec.20:	Mineral nutrition of pastures on the partly leached soils of Natal:
20/1:	- N, P, K and lime for *Eragrostis curvula* on a red soil of the D1 association, De Hoek. 1969. P.E. Bartholomew
*20/3:	- N, P, and K for *Eragrostis curvula* on a claypan soil of the F1 association, De Hoek. 1969. P.E. Bartholomew
O-Gl.147/4:	Evaluasie van *Anthephora pubescens*: N.P.K.-bemestingsproef. 1976. L.F. Vorster, A.H.G. Kruger
SW-WK.5/5:	Evaluasie van Anthephora pubescens: N.P.K.-bemestingsproef. 1977. J.G.S. Steenkamp
T-Ng.25:	*Eragrostis curvula* (weeping lovegrass) in the Drakensberg grazing area:
25/8:	- Type, level and distribution of phosphatic fertilizer. 1969. N.F.G. Rethman, B.H. Beukes
25/9:	- Distribution of phosphatic fertilizer during the season. 1971. N.F.G. Rethman, B.H. Beukes
25/10:	- Influence of burning, level of nitrogen fertilization and height of stubble on seed production. 1973. N.F.G. Rethman, B.H. Beukes
T-Rp.31:	Evaluation of *Cenchrus ciliaris*:
31/2:	- Effect of row espacement, seeding rate and nitrogen fertilization. 1973. C.H. Donaldson, B.J.M. Nel
31/3:	- Distribution of nitrogenous fertilizer. 1972. C.H. Donaldson, B.H. Robinson, G.T. Rootman, C.J. Breytenbach
31/4:	- Nitrogenous fertilizers different forms. 1972. C.H. Donaldson, B.H. Robinson, G.T. Rootman, C.J. Breytenbach
31/5:	- Nitrogenous fertilizer applied according to soil moisture and rainfall. 1972. C.H. Donaldson, B.H. Robinson, G.T. Rootman, C.J. Breytenbach
T-Tw.1:	Bemesting van *Panicum coloratum* en *Cenchrus ciliaris* met stikstof en fosfaat. 1955. J.J. van der Merwe
W-Tk.6/2:	Bemestingsaspekte van aangeplante en natuurlike weidings in die Winterreënstreek: Bepaling van die fosforverliese van eenjarige Meditereense peulgewasse in die Winterreënstreek. 1976. J.D. Langenhoven

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*N-Ce.76/2:	Defoliation of cultivated pastures: Frequency and height of mowing of *Paspalum-Ladino* pastures in summer and in autumn. 1966. R.I. Jones
N-Ce.98:	Competition in grass associations:
*98/4:	- Effect of selective defoliation. 1967. R.I. Jones
*98/6:	- Botanical changes in *Paspalum*-clover swards in relation to initial composition, fertilization and cutting frequency. 1967. R.I. Jones
*98/7:	- Effect of fertilization and cutting on swards of *Paspalum*, Ladino clover and mtshiki. 1967. R.I. Jones
*98/8:	- Effect of grazing on the relative aggressiveness of two grasses. 1968. R.I. Jones
*98/9:	- Effect of plant destiny on aggressiveness. 1969. R.I. Jones

N-Ec.12: Utilization of established pastures by grazing:

12/3: - Winter foggage. 1967. B.D. Mappledoram

12/4: - Stocking rates and grazing systems on *Paspalum dilatatum*. 1975. P.J. Edwards, R.I. Jones, C.I. MacDonald

12/5: - Characterisation of *Eragrotis curvula* in terms of the grazing animal. 1976. G.M. Brockett, A.D. Lyle, N.N. Gray

T-Ng.57/8: Optimum utilization of *Eragrostis curvula* by grazing animals. 1974. N.F.G. Rethman, B.H. Beukes, D.W. Eden, J.H. van der Walt, P.J.K. Morgan

T-Ng.63: Optimum utilization of natural climatic and edaphic resources in the South-Eastern Transvaal by the intensive utilization of cultivated pastures:

63/1: - Development of a viable beef/sheep farming system based on cultivated pastures. 1973. N.F.G. Rethman, D.W. Eden, C.J. Dreyer, J.C. Smit

W-Tk.3/3: Evaluering van weidingsgewasse en skaapbestuurpraktyke in die Rûensgebied van Suid-Kaap: Drakragstudies met aangeplante weidings. 1972. C.J. Pienaar, J.D. Langenhoven, J.M. van Heerden

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AW-Rd.2: Evaluasie van weidings- en voerpeulgewasse op Rietondale:

2/1: - Kwekerystudies met weidings- en voerpeulgewasse op Rietondale. 1978. C.J. Uys, C.J. Otto

H-Ps.240/1: Meerjarige aangeplante weidings onder besproeiing in die Hoëveldstreek: *Cenchrus ciliaris* cultivarproef. 1972. R.H. Drewes

N-Th.16: Evaluation of grasses and legumes in the Natal Region:

16/1: - *Dactylis glomerata* cultivar trial in the Highland Sourveld. 1969. B.D. Mappledoram

16/5 & 16/6: - *Trifolium repens* cultivar trial located in the Highland Sourveld of Natal. 1972. B.D. Mappledoram

16/7: - *Trifolium pratense* cultivar trial located in the Highland Sourveld of Natal. 1972. B.D. Mappledoram

16/37: - Phase 2 Stargrass evaluation trial on an "Estcourt" soil in the Tall Grassveld. 1978. B.D. Mappledoram, J.M. Cunningham

16/38: - Phase 2 Stargrass evaluation trial on an "Avalon" soil in the Tall Grassveld. 1978. B.D. Mappledoram, J.M. Cunningham

16/39: - Phase 2 Stargrass evaluation trial on an "Uitvlugt" soil in the Tall Grassveld. 1978. B.D. Mappledoram, J.M. Cunningham

16/42 - Phase two evaluation of selected grass/legume combinations in the drier phase of the Highland Sourveld of Natal. 1978. G.M. Brockett

O-Gl.147/5: Evaluasie van *Anthephora pubescens*: Reaksie van vyf ekotipes op beweiding. 1977. A.H.G. Kruger, L.F. Vorster

OK-Do.87: Herbage production trial for pasture species selection:

87/1: - *Dactylis glomerata* in the Eastern Cape Region. 1977. J.H. I'ons

SW-Hp.4: Evaluasie van weidingsgewasse in die Bosveldgebiede van S.W.A.

4/1: - Bepaling van die bemestingsbehoeftes en produksiepotensiaal van Cenchrus ciliaris (droëland) op die verskillende grondsoorte in S.W.A. 1977. J.G.S. Steenkamp, A.J. Steyn, G. Thomas, J. Barnard

SW-Hp.4/2: - Bepaling van die bemestingsbehoeftes en produksiepotensiaal van Digitaria polevansii op 'n kalaharigrond. 1977. J.G.S. Steenkamp, A.J. Steyn

SW-WK.5: Evaluasie van *Anthephora pubescens*:

5/1: - Ekotipe-evaluasie by twee bemestingspeile op rooileemgrond van die Damaragesteentes. 1977. J.G.S. Steenkamp

5/2: - Ekotipe-evaluasie by twee bemestingspeile op a swart turfgrond afkomstig van Dolomiet. 1977. J.G.S. Steenkamp

5/3: - Ekotipe-evaluasie by twee bemestingspeile op 'n kalahari-sandgrond. 1977. J.G.S. Steenkamp

5/4: - Reaksie op verskillende frekwensies en intensiteite van sny. 1977. J.G.S. Steenkamp

FOGGAGE

N-Ec.12/6: Utilization of permanent pastures by grazing: Foggage value of pastures in the Natal midlands. 1977. J. Arnott, A. Starke

HOOI/HAY

T-Ng.25: *Eragrostis curvula* (weeping lovegrass) in the Drakensberg grazing area:

25/7: - Height and stage of cutting. 1969. N.F.G. Rethman

25/11: - Comparison of hay feeding practices in evaluating the role of feedback on hay pastures. 1973. N.F.G. Rethman, B.H. Beukes

25/12: - Invloed van peil van bemesting en stadium van oes op die opbrengs en voedingswaarde van hooi. 1976. N.F.G. Rethman, C.J. Dreyer, B.H. Beukes, L. Bouwer

KWEKERYE/NURSERIES

H-Ps.234/1: Permanent cultivated pastures under dryland conditions in the western portion of the Highveld Region: Grass nursery. 1940. R.H. Drewes

N-Th.16/9: Evaluation of grasses and legumes in the Natal region: Preliminary evaluation of pasture plants at the Plant Materials Centre in the Tall Grassveld. 1968. B.D. Mappledoram

O-Gl.143/1: Evaluasie van weidingsplante in die Oranje Vrystaatstreek: Voorlopige waardebepaling van weidingsplante in 'n kwekery te Glen. 1973. J. du Toit, A.R. Blair

OK-Do.63/6: Introduction and evaluation of promising pasture species in the Eastern Cape: Pasture nursery, Dohne. 1976. J.H. I'ons

63/7: - Pasture nursery, Bathurst. 1976. R.A. Ingpen

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AW-Rd.1: Groeivereistes van belowende weidings- en voerpeulgewasse:

1/1: - Bepaling van inentingsvereiste van weidings- en voerpeulgewasse. 1977. V.D. Wasserman

1/2: - Bepaling van daglengte- en temperatuurvereistes vir normale blomvorming van bepaalde weidings- en voerpeulgewasse. 1978. V.D. Wasserman

1/3: - Screening of pasture legumes for soil acidity tolerance. 1977. J. Kamburov

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H-Bl.68: Produksie en evaluasie van wintergrane as weidingsgewasse in die Hoëveldstreek. 1977

K-Gf.124/2: Drakragnorme: Bepaling van biomassa en produksie van elf veldtipes in die Karoostreek. 1978. O.J.H. Bosch, P. Botha

T-Rp.31/7: Evaluering van *Cenchrus ciliaris*: Beesvleisproduksie vanaf aangeplante en natuurlike weidings op die Springbokvlakte. 1973. G. Marincowitz, B.H. Robinson, C.J. Breytenbach

RHIZOBIA

N-Ce.117: Rhizobia studies in Natal:
    117/1: - Selection of *Rhizobium* strains. 1967. P.J. Edwards, B.W. Strydom, C.I. MacDonald, B.D. Mappledoram, N.N. Gray

TELING/BREEDING

N-Ce.30: Improvement of *Paspalum dilatatum*. 1959. J.M.L.C. Rhind

N-Ce.33: Development of improved strains of Dactylis glomerata. 1959. J.M.L.C. Rhind

N-Ce.34: Development of improved strains of *Lolium multiflorum*. 1959. J.M.L.C. Rhind, J.D.H. Reusch, D.C.W. Goodenough

N-Ce.102: Breeding of *Eragrostis curvula* in the Natal Region:
    102/1: - Selection and breeding of superior cultivars. 1966. J.M.L.C. Rhind

N-Ce.146: Breeding of pasture legumes in Natal Region:
    146/1: - Trifolium species. 1977. A Smith

VOEDINGSWAARDE/NUTRITIONAL VALUE

W-Tk.3/8: Evaluasie van weidingsgewasse en skaapbestuurspraktyke in die Ruûensgebied van Suid-Kaap. 1976. T.T. de Villiers

VOORTPLANTING/REPRODUCTION

N-Ce.119: Survey of the mode of reproduction in certain grasses and legumes in South Africa:
    *119/1: - *Cynodon* spp. 1968. J.M.L.C. Rhind, J.D.H. Reusch, D.C.W. Goodenough
    *119/2: - *Pennisetum clandestinum*. 1968. J.M.L.C. Rhind, J.D.H. Reusch, D.C.W. Goodenough
    119/3: - Chloris gayana. 1970. J.M.L.C. Rhind
    119/4: - *Digitaria smutsii*. 1970. J.M.L.C. Rhind
    119/5: - *Acroceras macrum*. 1970. J.M.L.C. Rhind, J.D.H. Reusch, D.C.W. Goodenough

T-Ng.60/9: Saadvermeerdering van tropiese en subtropiese voerpeulgewasse. 1975. L.G. van Zyl

WAARDEBEPALING/EVALUATION

(A)VS-Pr.106: Evaluation of pastures for ruminant production:

(A)VS-Pr.106/1: - Evaluation of kikuyu pasture for ruminant production. 1977. R.A. Clark

H-Bl.64: Evaluasie van grasse en peulgewasse in die Oostelike Hoëveld:

64/1: - Vergelyking van die reaksies van tien peulgewasse op sny- en weibehandelings op 'n Avalon grondvorm (Soetmelkserie). 1974. J.A. Kruger

64/2: - Vergelyking van die reaksies van tien peulgewasse op sny- en weibehandelings op 'n Dundee grondvorm. 1974. J.A. Kruger

64/3: - Vergelyking van die reaksies van tien peulgewasse op sny- en weibehandelings op 'n Oakleaf grondvorm (Leeufonteinserie). 1974. J.A. Kruger

64/4: - Vergelyking van die reaksies van agt grassoorte op sny- en weibehandelings op 'n Avalon grondvorm (Soetmelkserie). 1974. J.A. Kruger

64/5: - Vergelyking van die reaksie van agt grassoorte op sny- en weibehandelings op 'n Dundee grondvorm. 1974. J.A. Kruger

64/6: - Vergelyking van die reaksies van agt grassoorte op sny- en weibehandelings op 'n Oakleaf grondvorm (Leeufonteinserie). 1974. J.A. Kruger

H-Ps.234/4: Permanente aangeplante weidings onder droëlandtoestande in die westelike deel van die Hoëveldstreek: Die relatiewe waarde van *Eragrostis curvula* en *Digitaria.* 1977. C.S. Dannhauser

H-Ps.254: Vestiging van dekgewasse en stabilisering van gronde vir waterafloopbeheer.

254/1: - Evaluasie van 'n aantal grasse vir uiteindelike aanplanting op waterbane op 'n Hutton grondvorm. 1976. C.S. Danhauser

N-Ce.111/24: Veld replacement studies: Evaluation of top kikuyu selections for cold tolerance resistance to "yellow" disease and seedling vigour. 1977. J. Arnott

N-Ce.132: Evaluation of *Cynodon dactylon* cv. Coastcross II in the Eastern Grassveld:

132/2(K): - Performance of a beef cow herd when grazed continuously on Coastcross II pastures at Umlaas Road. 1974. J.K. Arnott

132/4: - Performance of a beef yearling herd when grazed continuously on Coastcross II pastures at Cedara. 1974. J.K. Arnott

N-Ce.134/4: Evaluation of pasture plants in the Natal Region: Evaluation of *Lolium multiflorum* cultivars at various planting dates. 1977. D.C.W. Goodenought, C.I. MacDonald

N-Ce.142: Herbage production trials for pasture species selection. 1977.

142/1: - *Dactylis glomerata* in Natal Region. 1977. B.D. Mappledoram

N-Ec.10/4: Evaluation of plant species and cultivars for pastures: *Eragrostis curvula* cultivar experiments on the Clovelly soil type in the Highland Sourveld of Natal. 1964. E.P. Mappledoram, J.H. Cunningham

N-Th.16/10: Evaluation of grasses and legumes in the Natal region: Phase 2 pasture evaluation trial on a Shortlands soil series in the Tall Grassveld. 1968. P.J. Edwards. C. Apsey

16/17: - Screening of *Eragrostis curvula* and *Acroceras macrum* selections in the Highland Sourveld. 1972. B.D. Mappledoram

16/23: - Beef production on star grass at three stocking rates. 1972. P.J. Edwards, C. Apsey

16/25(K): - Phase 3 evaluation of various tropical grasses and legumes grown on a soil typical of the Longland series. 1972. J.K. Arnott

16/26: - Comparison of various tropical grasses and legumes when grown at Kokstad on a soil typical of the Doveton series. 1973. G.M. Brockett, N.N. Gray

N-Th.16/27:	- Comparison of various tropical grasses and legumes when grown at Kokstad on a soil typical of the Arrochar series. 1973. G.M. Brockett, N.N. Gray
16/31:	- Evaluation of techniques for the characterization of seasonal production potential of pastures in terms of livestock products. 1975. G.M. Brockett
16/32:	- Classification, processing and assessment of available data. 1976. G.W. Cross
16/33:	- Companion legumes for Kikuyu *Pennisetum clandestinum*) under different management systems. 1976. N.G.E. Hackland, G.W. Cross, C.I. MacDonald
16/34:	- The evaluation of grasses and legumes in the Natal Region: Companion legumes for a stargrass pasture under different management systems. 1975. N.G.E. Hackland, G.W. Cross, C.I. Macdonald
16/35:	- Companion legumes for Coastcross II (*Cynodon dactylon* hybrid) pasture under different management systems. 1976. N.G.E. Hackland, G.W. Cross, C.I. MacDonald
16/36:	- Production and persistence of legumes in a kikuyu pasture. 1976. N.G.E. Hackland, G.W. Cross, C.I. MacDonald
N-Th.16/40:	Evaluation of grasses and legumes in the Natal Region: *Trifolium pratense* cultivar trial located in the Highveld Sourveld of Natal. 1978. B. Mappledoram
16/41:	- *Trifolium pratenses* cultivar trial located in the Highland Sourveld of Natal. 1978. B. Mappledoram
O-Gl.143:	Evaluering van weidingsplante in die Oranje-Vrystaatstreek:
143/2:	- Voorlopige waardebepaling van weidingsplante in 'n kwekery te Vaalharts-Landbounavorsingstasie. 1974. A.H.C. Kruger, J. du Toit
O-Gl.147/1:	Evaluasie van *Anthephora pubescens*: Ekotipe-evaluasie by twee bemestingspeile op 'n grond van die Manganoserie. 1976. A.H.G. Kruger
147/2:	- Ekotipe-evaluasie by twee bemestingspeile op 'n grond van die Annadaleserie te Vryburg. 1976. L.F. Vorster, A.H.G. Kruger
147/3:	- Ekotipe-evaluasie by twee bemestingspeile op 'n grond van die Sunburyserie te Vergeleë. 1976. L.F. Vorster, A.H.G. Kruger
OK-Do.63:	Introduction and evaluation of promising pasture species in the Eastern Cape:
63/4(K):	- Evaluation of beef production potential at Jessie Farm, Komga. 1973. L.O. Nel
63/5:	- Evaluation of livestock production on greenleaf desmodium/grass pasturex at Fairview, Bathurst. 1973. F.O.C.W. Karberg
63/8:	- Screening of species for veld reinforcement in the Dohne Sourveld. 1975. J.H. I'ons
63/9:	- Evaluation of stargrass for beef production at Woodbury, Komga district. 1976. J.H. I'ons
63/11(K):	- Growth pattern of stargrass (*Cynodon aethiopicus*). 1976. J.H. I'ons
T-Ng.60:	Evaluering van grasse en peulplante in die Suidoostelike Transvaal:
60/1:	- Evaluation of *Eragrostis curvula* for intensive sheep production. 1972. N.F.G. Rethman, B.H. Beukes, H.S. Steynberg
60/2:	- Evaluering van peulplante in 'n kikoejoe (*Pennisetum clandestinum*)-weiding. 1973. N.F.G. Rethman, C.C. de Witt
60/3:	- Determination of the growth potential of grasses as cultivated pastures under irrigation. 1973. N.F.G. Rethman, B.H. Beukes

T-Ng.60/4: - Vrywillige inname van ureum- en melassebehandelde *Eragrostis curvula*-hooi in verskillende fisiese vorms deur skape en beeste. 1973. D.W. Eden, C.J. Dreyer, W.R.F.J. le Roux

60/5: - Evaluering van peulplante in assosiasie met *Eragrostis curvula*. 1973. N.F.G. Rethman, C.C. de Witt

60/6: - Evaluation of perennial dryland grass pastures for livestock production systems. 1973. N.F.G. Rethman, C.C. de Witt

60/11: Evaluation of grasses and legumes in the South-Eastern Transvaal: Influence of length of rest prior to the winter on the feeding value of kikuyu. 1974. N.F.G. Rethman, C.C. de Witt

T-Rp.31: Evaluation of *Cenchrus ciliaris*:

31/1: - Performance of *Cenchrus* when used exclusively for summer grazing. 1972. C.H. Donaldson, B.H. Robinson, C.J. Breytenbach

31/6: - Studie van verskillende benuttingstye en -intensiteite van Cenchrus-weidings met beeste. 1972. C.H. Donaldson, B.J.M. Nel

31/8: - Pilot study of a method establishing seasonal growth patterns. 1972. C.H. Donaldson, G. Rootman

31/9: - Evaluation of *Cenchrus ciliaris* ecotypes in terms of dry matter intake. 1973. C.H. Donaldson, G. Rootman

31/10: - Evaluation of irrigated *C. ciliaris* and other tropical pastures for intensive sheep production. 1973. C.H. Donaldson, G. Rootman

31/11: - Ondersoek na die produksiewaarde van mediumkwaliteit *Cenchrus ciliaris*-hooi. 1975. J.P. Pienaar, P.J.K. Morgan

T-Rp.40/1: Evaluering van grasse en peulgewasse vir die bosveldgebiede van Transvaalstreek: Tweede fase produksiebepaling van Digitaria introduksies. 1975. L.G. van Zyl

40/2: - Produksiebepaling van *Panicum maximum* Jacq. introduksies. 1975. L.G. van Zyl

T-Rp.45/2: Evaluasie van *Pennisetum typhoides* as 'n voergewas: Die potensiaal van babala *Pennisetum typhoides* as somergewas. 1977. C.H. Donaldson, G.T. Rootman

T-Vl.34: Ontwikkeling van aangeplante weidings in die boerderygebiede van die Transvaalstreek:

*34/1: - Opname van aangeplante weidings. 1973. J.N.S. du Preez

34/2: - Evaluasie van aangeplante weidings in die Waterberggebied. 1973. J.J. Coetzee, B.H. Robinson, C.H. Donaldson

W-Oq.7: Kwekerystudies. 1955. J.H. Blomerus

W-Sb.96/3: Ekologiese studie van Robertson Karoo: Evaluering van saadvermeerdering van natuurlike weidingsgewasse te Worcester veldreserwe. 1977. F.G.J. van der Westhuizen

VELD

BEMESTING/FERTILIZERS

H-Bl.63: Radikale veldverbetering in die oostelike Hoëveldstreek:

63/4: - Melkproduksie op bemeste veld. 1972. J.A. Kruger

H-Ps.228: Radikale veldverbetering in die noordelike variant van die *Cymbopogon-Themeda*-veld en in die westelike variant van die Bankenveld:

H-Ps.228/2: - Veld fertilization in the Bankenveld. 1968. G. Coetsee

228/6(K): - Stikstofbemesting van veld op sanderige grond in die Bothavilledistrik. 1969. G. Coetsee

228/7: - Invloed van verskillende stikstof- en fosfaatbemestingspeile op die plantmateriaalopbrengs van *Cymbopogon-Themeda*-veld. 1970. G. Coetsee

228/9: - Invloed van stikstofbronne op *Cymbopogon-Themeda*-veld. 1970. G. Coetsee

228/10: - Invloed van verskillende fosfaatbronne op *Cymbopogon-Themeda*-veld. 1970. G. Coetsee

N-Ce.121/3: Veld fertilization in Natal: Effect of fertilizer on production of the veld at Kokstad. 1971. N.N. Gray, G.M. Brockett

N-Dd.5/3: Radical veld improvement in the Sandy Sourveld of Natal: Fertilization and reinforcement of old lands under grazing - Dundee. 1972. P.E. Bartholomew, E.P. Theron, S.F. Lesch, H.J. Meaker

T-Ng.46: Radikale veldverbetering in die Suidoostelike Transvaal:

46/1(K): - Bemesting van Noordoostelike Sanderige Hoëveld. 1970. N.F.G. Rethman

46/2(K): - Fertilization of North-Eastern Mountain Sourveld. 1969. N.F.G. Rethman, B.H. Beukes

46/6: - Influence of fertilization and paraquat on the feeding value of veld in the winter. 1973. N.F.G. Rethman, G.D. Kotzé

T-Ng.60: Evaluation of grasses and legumes in the South-Eastern Transvaal:

60/10: - Influence of level and distribution of fertilizer on kikuyu. 1975. N.F.G. Rethman, C.C. de Witt

T-Pr.40: *Eragrostis curvula* (Ermelotipe): Bemestingsproef met stikstof en superfosfaat. 1950. A.J. Pienaar

T-Pr.41: *Eragrostis curvula* (Pretoriatipe): Bemestingsproef ammoniumsulfaat en superfosfaat. 1951. A.J. Pienaar

T-Pr.73: Bemesting van somergras- en peulplantmengsels met stikstof en fosfaat. 1953. A.J. Pienaar

T-Pr.75: Proef met verskillende stikstofhoudende kunsmisstowwe op veld. 1953. A.J. Pienaar

T-Tw.2: Veldbemestingsproef met stikstof en fosfaat. 1949. B.H. Robinson

BESTUUR/MANAGEMENT

H-Ps.60: Seisoensbewyding van Themeda-Cymbopogon-veld:

60/1: - Beweiding van die veld gedurende bepaalde jaargetye, alleen en in kombinasie. 1963. G. Coetzee

H-Ps.118: Gousiekteprobleem:

118/8: - Effect of fertilization on *Pachystigma pygmaeum*. 1971. R.H. Drewes

118/9: - Growth and development of *Pachystigma pygmaeum*. 1971. R.H. Drewes

118/10: - Fenac-konsentrasies by die beheer van *Pachystigma pygmaeum*. 1971. G. Coetsee

118/11: - Invloed van kampgrootte en weidruk op gousiektevergiftiging. 1972. G. Coetsee

H-Ps.228: Radikale veldverbetering in die noordelike variant van die *Cymbopogon-Themeda*-veld en in die westelike variant van die Bankenveld:

228/8: - Effect of height of selective defoliation and fertilization on *Cymbopogon-Themeda*-veld. 1970. R.H. Drewes

228/11: - Veldproduktiwiteitsevaluering met diermassaveranderings oor verskillende weitydperke. 1970. G. Coetsee

228/12: - Invloed van benuttingspraktyke op stikstofbemeste *Cymbopogon-Themeda*-veld. 1970. R.H. Drewes

H-Ps.229: Weiveldbeheer in die noordelike variant van die *Cymbopogon Themeda*-veld en in die westelike variant van die Bankenveld:

229/1: - Bestuur van klipveld wat met gousiektebossie *(Pachystigma pygmaeum)* besmet is. 1968. G. Coetsee

229/3: - Effek van verskillende frekwensies en hoogtes van ontblaring op die produksie van veldgrasse. 1972. G. Coetsee

K-Gf.1: Veld grazing experiment: Camp No 6. 1934. P.W. Roux

K-Gf.2: Veld grazing experiment: Seligman Old Block. 1941. P.W. Roux

K-Gf.3: Veld grazing experiment: Hill Camp. 1943. P.W. Roux

N-Ko.7: Veld management studies in East Griqualand:

7/1: - Comparison of four variations of the four-camp system. 1967. G.M. Brockett, N.N. Gray

*7/3: - Investigation of effects of winter utilization of summer spared sourveld. 1971. R.H. Drewes, N.N. Gray

N-Th.3: Veld burning and/or mowing without grazing. 1944. B.D. Mappledoram

O-Gl.141/2: Vasstelling van norme om die drakrag van die natuurlike veld van die Oranje-Vrystaatstreek te bepaal: Produksiepotensiaal van die natuurlike veld van die Vrystaatgedeelte van die Oranje-Vrystaatstreek. 1973. L.F. Vorster

OK-Do.50: Studies on various grazing systems for the Dohne Sourveld:

50/1: - Continuous grazing by cattle and prolonged grazing with periodic sparing. 1939. A.J. Aucamp

50/2: - Rotational resting from January to January. 1961. A.J. Aucamp

50/6: - Response of *Elyonurus argenteus* to different defoliation treatments. 1971. L.O. Nel

50/8: - Stocking density and species and area selection. 1972. T. Daines, L.O. Nel

50/9: - Invloed van wisselweistelsels op veldkwaliteit en droë materiaalinname. 1972. A.J. Aucamp

OK-Do.69: Ekologiese studies van die Valleibosveld in die Oos-Kaapstreek:

69/1(K): - Ondersoek na die invloed van ontblaring op *Portulacaria afra*. 1971. A.J. Aucamp

69/2: - Ondersoek na die reserwestatus van *Portulacaria afra*. 1972. A.J. Aucamp

69/3: - Ondersoek na die invloed van rus op die kwaliteit en produksie van die Valleibosveld. 1973. A.J. Aucamp

69/4: - Ondersoek na die weidingspotensiaal van die Valleibosveld. 1973. A.J. Aucamp

69/5: - Ondersoek na die produksie van *Portulacaria afra*. 1972. A.J. Aucamp

OK-Do.83: Optimale ontwikkeling en benutting van die droë gras/bosgemeenskappe van die Oos-Kaapstreek:

83/1: - Ontwikkeling van 'n praktiese, aanvaarbare boerderystelsel te Adelaide. 1976. A.J. Aucamp

VELD

SW-Kh.2: Produksie- en veldbestuurstelsels in Suidwes-Afrika:

- 2/1: Benutting van Ariede Kalaharieveld met ses produksiestelsels. 1976. J.P. van Niekerk, G.J. Agenbach
- 2/2: Benutting van die Dwergstruiksavannaveld met vier produksiestelsels. 1976. J.P. van Niekerk, D. Kotze

T-Ng.42/2: Defoliation by mechanical means of the North-Eastern Sandy Highveld: Influence on the sward of winter defoliation. 1968. N.F.G. Rethman, B.H. Beukes

T-Ng.53/1: Evaluasie van natuurlike suurveld in die Suidoostelike Transvaal: Voedingswaarde van natuurlike veld bepaal met gefistuleerde diere in 'n beheerde selektiewe weidingstelsel. 1972. D.W. Eden, E.B. Spreeth, S.C.N. West

T-Ng.55/1: Optimum utilization of 'extensive' sourveld in the South-Eastern Transvaal, eliminating untimely burning: Development of a viable stock-farming system. 1969. N.F.G. Rethman, D.W. Eden, C.J. Dreyer, J.C. Smit

T-Pr.74: Brand- en snyproef op veld. 1950. A.J. Pienaar

T-Tw.22: Ononderbroke beweiding en vasgestelde seisoenswisselingstelsels: Towoomba-navorsingstasie. 1935. B.H. Robinson, C.J. Breytenbach

W-Nt.1: Veldbeweidingstudies by die Nortierproefplaas:

- *1/1: Invloed van seisoensbeweiding op veld. 1965. F.G.J. van der Westhuizen
- 1/5: Invloed van afsonderlike en gesamentlike beweiding deur skape en beeste op die bedekking en samestelling van die Kusfynbos van die Strandveld. 1973. F.G.J. van der Westhuizen

BYVOEDING/SUPPLEMENTATION

T-Ng.57: Optimumbenutting van suurgrasveld in die Suidoostelike Transvaal waar ploegbare grond vir voerproduksie beskikbaar is:

- 57/1: Die ekonomie van kruipvoeding en vroegspeen van lammers. 1972. C.J. Dreyer, H.S. Steynberg, J.H. van der Walt, N.F.G. Rethman
- 57/2: Supplementêre voeding van dragtige ooie met die oog op verhoogde produktwiteit. 1972. D. Els, C.J. Dreyer
- 57/5: Development of a viable stock-farming system for semi-extensive sourveld. 1971. N.F.G. Rethman, D.W. Eden, C.J. Dreyer, J.C. Smit
- 57/7: Mineralestatus van skape op die Oostelike Hoëveld van Transvaal. 1973. H. Steynberg, C.J. Dreyer, P.A. Boyzoglu, J.A.C. Fourie

EKOLOGIE/ECOLOGY

K-Gf.126/1: Plantekologie (weiveldbeheer): Fotografiese opnametegnieke vir die evaluering en meet van veranderinge in Karooplantegroei. 1974. P.W. Roux

K-Kn.4: Reaksie van dorre Karooveld op beweiding gedurende spesifieke jaargetye:

- *4/1: Boesmangrasveld: 1964. L.J. Viljoen
- *4/2: Vlaktebossieveld. 1964. L.J. Viljoen, J.A. van den Berg

O-Gl.72: Ontblaring van droë Cymbopogon-Themeda-veld:

- 72/4: Vergelyking van vier wisselweidingstelsels onder twee beweidingsintensiteite. 1967. L.F. Vorster, P.C.N. Goosen

O-Gl.119: Veldstudies op beplande plase in die Oranje-Vrystaatstreek:

- 119/1: Skynkaroo veld van die suidelike en suidwestelike Oranje-Vrystaat. 1963. L.F. Vorster, A.F.J. Visagie, P.C.N. Goosen

O-Gl.119/2:	- Sentraal- en Suidoos-Oranje-Vrystaat. 1968. L.F. Vorster, P.C.N. Goosen
OK-Do.79:	Botaniese opname van die Bo-Oranjerivier-opvanggebied:
*79/1:	- Melkspruit-subopvanggebied. 1974. L. Viljoen
*79/2:	- Waschbankspruit-subopvanggebied. 1974. L. Viljoen
*79/3:	- Saalboomspruit-subopvanggebied. 1974. L. Viljoen
*79/4:	- Sterkspruit-subopvanggebied. 1974. L. Viljoen
*79/5:	- Oslaagte-subopvanggebied. 1974. L. Viljoen
79/6:	- Subopvanggebiede Stormbergspruit, Bamboes, Wonderboom en Bo-Stormberg. 1974. J.J. van Pletzen
T-Mr.9/2:	Invloed van beweiding deur beeste, skape en bokke in Noord-Transvaal: Bokke en/of beeste op mopanieveld. 1969. C.H. Donaldson
*W-Sb.96/2(K):	Ekologiese studie van die Robertson-Karoo: Herwinning en verbetering van renosterbosveld. 1966. F.G.J. van der Westhuizen

GROEISTUDIES/GROWTH STUDIES

T-Ng.44/2:	Growth and development of perennial veld grasses in the Eastern Transvaal Highveld: *Andropogon amplectans* and *Eulalia villosa*. 1973. N.F.G. Rethman, G.D. Kotzé

HERBARIA

OK-Do.85:	Reference herbaria in the Eastern Cape Region:
85/1:	- Dohne. 1976. M.J. Jacobs

HERWINNINGSTUDIES/RECLAMATION STUDIES

K-Gf.144:	Veldherwinning:
144/1:	- Benutting en bestuur van *Phragmites australis* (fluitjiesriet). 1978. P. Botha
SW-Om.4:	Ontwikkeling van die verboste gebiede in Suidwes-Afrika:
4/2(K):	- Uitwerking van lugbespuiting met Tordon 225 op die veld en diereproduksie asook die ekonomiese implikasies daarvan. 1975. J.P. van Niekerk, F.V. Bester
T-Mr.12:	Veldherwinning in die Noord- en Noordwes-Transvaalse bosveld:
12/1:	Intensifikasie van die weidingsvermoë van die soetbosveld. 1972. C.H. Donaldson, B.J.M. Nel

INSEKTEPLAE/INSECT PESTS

(A)I-Pr.45:	Grasshoppers and locusts of South Africa. 1958. H.D. Brown
(A)I-Pr.129:	Bio-ecological studies of insects associated with Karooveld:
129/1:	- Bio-ecological study of the Karoo caterpillar, *Loxostege frustalis* Zeller. 1975. J.D. Möhr, M.W. Pretorius
N-Ce.120/1:	Grondbewonende insekte (uitsluitend Isoptera) wat landbouproduksie in Natal nadelig kan beïnvloed. 1970. P.C. Joubert

ONGEWENSTE PLANTE/UNDESIRABLE PLANTS

(A)I-Pr.61:	Biologiese beheer van turksvy en litjieskaktus *(Opuntia megacantha)* en litjieskaktus (*O. aurantiaca*):

(A)I-Pr.61/1: - Biologiese beheer van turksvy (*Opuntia megacantha*). 1960. H.G. Zimmermann, W.A. Burger

61/2: - Biologiese beheer van litjieskaktus (*Opuntia aurantiaca*). 1960. H.G. Zimmermann, W.A. Burger

61/3: - Evaluation of *Dactylopius austrinus* as a natural enemy of jointed cactus. 1976. H.G. Zimmerman

61/4: - Release and establishment of *Tucumania tapicola* as a new biocontrol agent of jointed cactus. 1976. J.H. Hoffman

(A)I-Pr.63: Biological control of the weed *Lantana camara*. 1960. Carina J. Cilliers

(A)P-Pr.20/1: Plantkundige aspekte van gifblaar, *Dichapetalum cymosum*, in die Transvaalstreek: Morfologiese en ekologiese studie in die Pretoria-omgewing. 1968. J. Vahrmeijer

O-Gl.137/3: Radikale veldverbetering in die O.V.S.-streek: Uitroei en beheer van *Nestlera prostrata*. 1976. A.R. Blair, A.J. van Schalkwyk

OK-Do.68: Beheer van ongewenste plantspesies in natuurlike plantegroei:

68/4: - Reaksie van *Sencio retrorsus* op verskillende ontblaringsbehandelings op die veld. 1972. B.D. Viljoen

68/5: - Reaksie van *Senecio retrorsus* op verskillende bemestingsbehandelings. 1972. B.D. Viljoen, L.E. Römer

*68/6(K): - Bespuitings en oorsaai van *Nasella trichotoma*. 1975. L.O. Nel

OK-Do.68/7: Control of undesirable plant species in natural vegetation: Spraying and burning of Nasella. 1977. J.H. I'ons

SW-Om.4: Ontwikkeling van die verboste gebiede in Suidwes-Afrika:

4/1(K): - Chemiese uitroeiing van indringerbosse deur middel van lugbespuiting. 1974. J.P. van Niekerk

SW-Sp.1/1: Beperking van veeverliese as gevolg van gifblaar (*Dichapetalum cymosum*) -vergiftiging: Invloed van beweidingsintensiteit, kampstelsels en proteïenaanvulling op die uitskakeling van die nadelige effek van gifblaar. 1966. J.P. van Niekerk

OUTEKOLOGIE/AUTECOLOGY

W-Nt.1/6: Veldbewaringstudies by die Nortierproefplaas: Invloed van seisoenale ontblaring op die reserwes en droëmateriaalproduksie van Karoobossies en gras. 1977. F.G.J. van der Westhuizen

PRODUKSIE/PRODUCTION

OK-Do.83/3(K): Optimale ontwikkeling en benutting van die droë gras/bosgemeenskappe van die Oos-Kaapstreek: Invloed van *Acacia karroo* op voerproduksie. 1977. A.J. Aucamp

RADIKALE VELDVERBETERING/RADICAL VELD IMPROVEMENT

H-Bl.63/5: Radikale veldverbetering in die oostelike Hoëveldstreek: Waarde van droëlandgras/peulgewasweidings vir melkproduksie. 1978. J.A. Kruger, K.G. Cronje

63 6: - Waarde van droëlandgras/peulgewasweidings vir skape gedurende dragtigheid. 1978. J.A. Kruger, A.J. van Heerden

H-Ps.228: Radical veld improvement in the northern variation of the *Cymbopogon-Themeda* veld and in the western variation of the Bankenveld:

H.Ps.228/1:	- Evaluation of introduced plant species. 1967. R.H. Drewes
228/15:	Overseeding of fertilized Cymbopogon-Themeda veld. 1972. R.H. Drewes
228/16:	- Summer production systems for Cymbopogon-Themeda veld. 1973. R.H. Drewes
H.Ps.253:	Benutting van radikaal verbeterde veld. 1976:
253/1:	- Somerbenutting van veld en RVV deur Simmentalerkoeie met kalwers. 1976. J.W. Cilliers
N-Ec.17:	Radical veld improvement in the Highland Sourveld of Natal:
17/14:	- Preliminary comparison of different forms of radical veld improvement. 1971. P.J. Edwards, B.D. Mappledoram, S.F. Lesch
17/15:	- Preliminary comparison of different forms of radical veld improvement involving the use of beef cows and calves. 1973. P.J. Edwards, S.F. Lesch, B.D. Mappledoram
17/16:	- Effect of different classes of pasture on the productivity of cow herds. 1976. P.J. Edwards, B.D. Mappledoram, S.F. Lesch
O-Gl.137/3(K):	Radikale veldverbetering in die Suid-Oos en sentrale O.V.S.: Uitroei en beheer van *Nestlera prostrata*. 1976. A.R. Blair
T-Ng.46:	Radikale veldverbetering in die Suidoostelike Transvaal:
46/4:	- Introduction of rhizomatous grasses into veld. 1970. B.H. Beukes, N.F.G. Rethman
46/5:	- Establishment of *Pennisetum clandestinum* in non-arable natural veld. 1972. N.F.G. Rethman, G.D. Kotzé
46/7:	- Vestiging van meerjarige peulplante in natuurlike veld in die Suidoostelike Transvaal. 1974. N.F.G. Rethman, C.C. de Witt
46/8:	- Comparison of *Vigna vexillata* reinforced veld with natural veld for autumn grazing by sheep. 1973. G.D. Kotzé, N.F.G. Rethman, W.R.E. Nursery
T-Ng.60/7:	Evaluering van grasse en peulplante in die Suidoostelike Transvaal: Verbouing van lusern op verskillende agro-ekologiese eenhede onder verskillende spasiërings en saaidigthede. 1976. N.E. Rethman, C. de Witt

VELDVERVANGING/VELD REPLACEMENT

N-Ce.111:	Veld replacement studies:
111/13:	- Effect of fertilizer on productivity of veld oversown with *Eragrostis curvula*. 1969. J.K. Arnott
111/19(K):	- Effect on animal production of the radical improvement of veld in East Griqualand by fertilizing and oversowing. 1972. G.M. Brockett, N.N. Gray, J.K. Arnott, S.F. Lesch
111/20:	- Comparison of different forms of radical veld improvement at the Kokstad research station. 1973. G.M. Brockett, S.F. Lesch, A.D. Lyle, N.N. Gray
111/21(K):	- Effect on animal production of radical improvement of the Highland Sourveld (Balgowan) by fertilizing and oversowing. 1973. J.K. Arnott,
N-Th.16:	Evaluation of grasses and legumes in the Natal Region:
16/16:	- Preliminary evaluation of pasture plants in the Highland Sourveld. 1970. B.D. Mappledoram

VERSTERKING/REINFORCEMENT

W-Vl.16/9: Weiveldverbetering in die Klein Karoo: Veldverbetering in die karooagtige gebroke veld deur die insaai van nuttige plantsoorte. 1976. L.E. Nolte

VOEDINGSWAARDE/NUTRITIONAL VALUE

H-Ps.173: Biochemiese ondersoek na die voedingswaarde van veldgrasse:

- 173/4: Koolhidraatfraksies en lignieninhoud van *Themeda triandra* 1968. J.W. Cilliers
- 173/5: Voedingswaarde van bemeste veld. 1971. J.W. Cilliers
- 173/6: Invloed van bemesting op die voedingswaarde van veldhooi. 1973. J.W. Cilliers

O-Gl.125/22: Evaluasie van voedingswaarde van ruvoere en weidings: Evaluering van die voedingswaarde van die natuurlike weiding van die Oranjerivier gebroke veld en Kalahari-duineveld. 1977. A.S. Faure, D.A. Boshoff, E.A.N. Engels, F.J.L. Burger

WAARDEBEPALING/EVALUATION

N-Ko.5/5: Production systems for beef cattle in East Griqualand: Evaluation of veld potential in terms of production per animal and per hectare. 1975. A.D. Lyle, G.M. Brockett

O-Gl.72/5: Vergelykende ontblaringstudies binne in beheerde selektiewe beweiding met wisselende aantal kampe. 1976. L.F. Vorster, A.F.J. Visagie, P.C.N. Goosen

O-Gl.141/3: Evaluasie van die produksiepotensiaal van Kalkveld in die noordoostelike gebied van die Ghaapse plato. 1977. J.H. Fourie

O-Kf.17/1: Vaalbosstudies op die Ghaapse plato: Waarde van vaalbos as weiding vir skape. 1964. W.R.E. Nursery

OK-Do.83/2(K): Optimale ontwikkeling en benutting van die droë gras/bosgemeenskappe van die Oos-Kaapstreek: Evaluasie van die produksiepotensiaal van 'n Acacia/grasgemeenskap. 1977. A.J. Aucamp

T-Ng.56: Seleksie deur dier en evaluasie van die Suidoostelike Transvaal Suurveldtipes:

- 56/2: Veldobservasie. 1971. G.D. Kotzé, N.F.G. Rethman
- 56/3: Ondersoek van oesophageale fistula monsters. 1971. B.H. Beukes, N.F.G. Rethman, G.D. Kotzé

DIEREPRODUKSIE/ANIMAL PRODUCTION

Plaasdiere/Farm Animals

ALGEMEEN GENERAL

BEDRYFSONDERSOEK/ENTERPRISE INVESTIGATION

N-Ko.5/4: Production systems for beef cattle and sheep in the East Griqualand area: Growth of young cattle and sheep managed on a preference and follower herd basis within a rotational grazing system on summer veld. 1972. A.D. Lyle, R.M. Bredon, G.M. Brockett

BIOCHEMIESE STUDIES/BIOCHEMICAL STUDIES

(A)VS-Pr.93/1:	Evaluering en verbetering in energievoorsiening van laegehalte voere en veselryke afvalprodukte beskikbaar in Suid-Afrika vir herkouervoeding: *In vitro* verteerbaarheid van organiese stof in laegehalte voere en veselryke afvalprodukte in Suid-Afrika na behandeling met verskillende konsentrasies natriumhidroksied. 1974. H.S. Hofmeyr

INSEKTEPLAE -BEHEER/INSECT PESTS - CONTROL

OK-Do.75:	Control of the stable fly, *Stomoxys calcitrans*:

PRODUKSIESTUDIES/PRODUCTION STUDIES

T-Rp.30:	Produksievermoë van vee op optimaalbestuurde veld:
30/2:	- Produksievermoë van skape en bokke op *Acacia*-grasveld in die Suurbosveld. 1972. G. Marincowitz, J.G. Low, K.E. Oosthuizen
30/6:	- Produksievermoë van skape, beeste en bokke op *Acacia*-grasveld in die Sourbosveld. 1972. G. Marincowitz, J.G. Low, K.E. Oosthuizen

SEROLOGIESE STUDIES/SEROLOGICAL STUDIES

*(A)VS-Pr.38/4:	Bereiding van bloedgroepreagente en immunologiese studies by plaasdiere, laboratoriumdiere en verwante spesies: Voorkoms en spesifisiteit van antigeniese stowwe met natuurlikvoorkomende teenliggame. 1967. E.H.H. Meyer

SIEKTES - BAKTERIEë/DISEASES - BACTERIA

*OP-BACT.58:	Method of production of and antibody response to an oil adjuvant *Bacteroides nodosus* bacterin. 1975. C.M. Cameron, W.J.P. Fuls
OP-BACT.61:	Strain specificity in staphylococcal immunity. 1977. C.M. Cameron

SIEKTES - INWENDIGE PARASIETE/DISEASES - INTERNAL PARASITES

OP-HELM.34:	Herwinning van volwasse en onvolwasse rondewurms en eiers uit dermingesta en/of mis. 1976. J.A. van Wyk

SIEKTES - VIRUSSE/DISEASES - VIRUSES

OP-PATH.43:	Encephalitozoonosis in the sub-human primate caused by an Encephalitozoon isolated from the dog. 1977. A.F. van Dellen, Wilna F. Botha, C. Steward
OP-VIR.47:	Immunogenicity of RVF virus cultivated in BHK suspended cell cultures. 1977. A. Pini, W. Ashford, P.J. van Rooyen, J. Esterhuizen

SITOGENETIKA/CYTOGENETICS

(A)VS-Pr.23:	Kariotiepstudies van die skaap (en die bees). 1965. E.H.H. Meyer

VLEISPRODUKSIE/MEAT PRODUCTION

(A)VS-Pr.76:	Kwantitatiewe en kwalitatiewe vleisproduksiestudies:
76/2:	- Liggaamsgroei, -samestelling en -bouvorm van skape en bokke. 1971. R.T. Naudé

*(A)VS-Pr.76/5: - Histologiese evaluering van die rol van bindweefsel in samestelling van vleis en die bepaling van vleiskwaliteit. 1972. J.H. Dreyer

76/10: - Verkoeling van beeskarkasse. 1976. R.T. Naudé

76/11: - Objektiewe ontleding van die huidige karkasgraderingstelsel. 1976. J.F.G. Klingbiel

T-Mr.15: Bestendige vleisproduksiestelsel vir die mopanieveld. 1968. J.F.G. Badenhorst, H.P. Eloff, C.J.F. Lüdemann, E.E. Lademan

VOEDING/NUTRITION

(A)VS-Pr.87: Benutting van proteïenbronne in die Republiek van Suid-Afrika:

87/1: - Chemiese en biologiese evaluasie van proteïenbronne. 1973. G.A. Smith

H-Ps.71: Bepaling van die voedingswaarde van Suid-Afrikaanse voergewasse. 1944. R.H. Drewes

K-Gf.129/3: Voedingswaarde van Karooweidings: Vrywillige inname, verteerbaarheid en chemiese samestelling van Karooveld soos deur kleinvee geselekteer. 1973. P.J.L. Zeeman

N-Ce.150: Analytical evaluation of feedstuffs in the Natal Region. 1978. J.P. Marais

O-Gl.123/5: Doeltreffende benutting van natuurlike veld in die O.V.S.-streek: Ondersoek na die beenfosforstatus van bees en skaap op veldweiding van Armoedsvalkte. 1979. B. Ferreira

O-Gl.125: Evaluering van die voedingswaarde van ruvoere en weidings:

125/2: - Voluntary intake and digestibility of different forages by cattle and sheep. 1964. J.A. Swart, E.A.N. Engels, B. Ferreira

125/10: - Ondersoek na 'n praktiese *in vitro* metode om die voedingswaarde van ruvoere vir herkouers te voorspel. 1967. E.A.N. Engels, A. van Schalkwyk, B. Ferreira, A. Malan

OK-Do.53/7: Wintering of cattle in the sourveld of the Eastern Cape: Comparison between the response of cattle and sheep receiving a non-protein nitrogen supplement. 1970. H.H. Barnard

OP-DMR.56: Factors affecting the microbial population of the rumen and the intake and digestion of roughage when increasing amounts of maize are added to a poor roughage diet. 1976. F.M.C. Gilchrist, R.I. Mackie, N.C. van Gylswyk, P.A. Henning, H.M. Schwartz, Y. van der Linden

OP-DMR.58: Ecological study of rumen protozoa. 1977. A.A. Evans

OP-NUT.11: Spoorelement-evaluasie d.m.v. leweranalisis. 1976. J. de V. du Toit

VOEDING- LAB. TEGNIEK/NUTRITION- LAB. TECHNIQUE

OP-DMR.51: Methods for releasing bacteria and protozoa from solid particles of ingesta. 1976. R.I. Mackie, F.M.C. Gilchrist, P.A. Henning

OP-DMR.52: Method for counting lactic acid-utilizing bacteria. 1976. R.I. Mackie

OP-DMR.53: Method for counting proteolytic bacteria. 1976. R.I. Mackie, J.J. Theron

OP-DMR.54: Methods for counting amylolytic and glucolytic bacteria. 1976. F.M.C. Gilchrist, R.I. Mackie

OP-DMR.55: Production and utilization of lactic acid by pure cultures of rumen bacteria. 1976. R.I. Mackie

WEIGEWOONTES/GRAZING HABITS

K-Gf.127: Weigewoontes:

127/1: - Selektiewe weigewoontes van skape, beeste en bokke. 1973. P. Botha

BEESTE/CATTLE

BEDRYFSONDERSOEK/ENTERPRISE INVESTIGATION

N-Ce.115/6: Production and reproduction in beef cattle: Wintering of pregnant beef cows. 1972. H.J. Meaker, S.F. Lesch

N-Ko.5/3: Production systems for beef cattle and sheep in the East Griqualand area: Effect of season of mating on reproductive and weaning performance of beef females. 1972. A.D. Lyle, G.J. Muller

SW-Om.2: Verhoogde beesvleisproduksie deur verbeterde bestuurspraktyke:

2/1: - Vroeg en laat speen van Afrikanerkalwers. 1967. J.P. Gressmann

2/2: - Veld-evaluasie en voerinname studies met beeste op natuurlike weiding. 1976. L.P. van Schalkwyk, J.P. Barnard F.J. Etsebeth

BEESPLAASPROEFBOERDERY/EXPERIMENTAL RANCHING

T-Rp.27: Soutpan-beesplaasproefboerdery. 1964. J.G. Low, G. Marincowitz, C.D. Kruger

BIOCHEMIE/BIOCHEMISTRY

(A)VS-Pr.35: Elektroforetiese en ander chemies-fisiese studies op plaasdiere, laboratorium en verwante species (Genetiese polymorfisme):

35/5: - Biochemiese en genetiese studies van 'n nuwe hemoglobienband by beeste. 1976. Marie Schwellnus, M.R. Schwellnus

35/6: - Milk protein polymorphism in cattle. 1976. G. Guerin, E.H.H. Meyer

35/7: - Biochemical genetic studies on haemoglobins. 1975. G. Guerin, E.H.H. Meyer

FISIOLOGIE/PHYSIOLOGY

(A)VS-Pr.44/1: Aspects of lactation in the production of milk or cream: Studies on the synthetic activity of the mammary gland. 1975. H. Lück

(A)VS-Pr.99/2: Vergelykings van maatstawwe vir die bepaling van steurnisse van die fisiologiese aktiwiteit van die lakterende uier. 1977. F. du Toit

OK-Do.66/6: Beesvleisproduksie in die Oos-Kaap: Invloed van spanning op die bynierkorteks-aktiwiteit van *Bos indicus* en Bos taurus verse onder ingekraalde toestande en onder veldtoestande. 1976. J.A. Erasmus

GESLAGSFISIOLOGIE/REPRODUCTIVE PHYSIOLOGY

(A)VS-Pr.39/3: Geslagsfisiologie van inheemse en uitheemse manlike diere in Suid-Afrika: Invloed van 'n hoër voedingspeil op die geslagsontwikkeling van Herefordbulle. 1971. D. Visser

(A)VS-Pr.79: Studies oor die reproduktiewe doeltreffendheid van die koei:

*79/1: - Invloed van intra-uterusruimte op die grootte van die Afrikanerfetus. 1971. D. Visser

(A)VS-Pr.79/3: - Early reproduction in beef heifers through increased growth rate using zeranol (Ralgro). 1974. D. Visser, G. Marincowitz

O-Vh.71/3: Reproduksie by beeste: Ondersoek na die fisiologiese en histologiese aspekte van die *post partum*-periode by die Afrikanerkoei. 1972. W.A. Coetzer, J.H. van Niekerk

KLIMAAT/CLIMATE

N-Th.12: Effect of certain environmental conditions on the growth, functional development and reproduction of beef cattle in some areas of Natal:

12/1: - Effect of different breeding and feeding areas. 1963. A.W. Lishman, S.F. Lesch, A. van Niekerk

12/2: - Effect of introduction to highland sourveld and thornveld conditions on the growth of beef weaners. 1964. A.W. Lishman, S.F. Lesch

MELKPRODUKSIE/MILK PRODUCTION

(A)VS-Pr.101: Statistiese metodes vir herhaalde waarnemings:

101/1: - Model vir die beskrywing van melkproduksie. 1976. C.Z. Roux

(A)VS-Pr.102: Eksperimentele ontwerp vir die veekunde:

102/1: - Interaksie tussen eksperimentele eenheid en behandeling. 1976. C.Z. Roux

H-Ps.242/2: Melkproduksiestelsels in die Hoëveldstreek: Chemiese evaluering van waterkulture. 1974. P.J. Boshoff

T-Mr.2: Melkproduksieproef. 1952. H.P. Eloff

W-Oq.18/2: Melkproduksiepotensiaal in die George- en Knysnagebied: Evaluering van voedingspraktyke vir melkkoeie. 1974. C.J.J. Brand

OORERFLIKE LAMINITIS/HEREDITARY LAMINITIS

(A)VS-Pr.24: Erflike gebreke en afwykings by plaasdiere:

24/1: - Studie van oorerflike laminitis by Jerseybeeste. 1965. E.H.H. Meyer

(A)VS-Pr.34: Laminitis by Afrikaner beeste:

34/1: - Studie van die oorerwing van laminitis by Afrikanerbeeste. 1971. E.H.H. Meyer

PRODUKSIESTUDIES/PRODUCTION STUDIES

N-Ce.115: Production and reproduction in beef cattle:

115/6: - Over-wintering of pregnant beef cows. 1973. H.J. Meaker

115/7: - Determination of the production potential and cost of farm-produced roughage. 1971. R.M. Bredon, A.D. Lyle, B.J. Lyle

*115/9: - Invloed van massa en ouderdom by puberteit op die reproduksievermoë van die vers. 1973. H.J. Meaker, T.P.N. Coetzee, R.K. Scott

115/11: - Benutting van *Eragrostis curvula* as winterweiding deur vleisbeeskoeie. 1974. H.J. Meaker, T.P.N. Coetzee

115/14: - Performance of dual purpose and British beef cattle on kikuyu pasture. 1976. B.P. Louw, P.E. Bartholomew, S.F. Lesch

115/15: - Effect of stocking rate and lick supplements on animal performance. 1975. S.F. Lesch, P. Whitwell, P.J. Edwards, A. van Niekerk, B.D. Mappledoram

*N-Ce.115/16: - Invloed van verskillende voedingspeile voor en na kalwing, op die reproduksievermoë van die koei. 1976. H.J. Meaker, T.P.N. Coetzee, R.K. Scott

O-Gl.131/1: Produksie van beesvleis: Intensivering van beesvleisproduksie deur middel van bestuur en voeding. 1969. J.A. Swart, E.A.N. Engels

T-Rp.30/3: Produksievermoë van vee op optimaalbestuurde veld: Produksievermoë van Bonsmarabeeste in die Suurbosveld. 1971. G. Marincowitz, J.G. Low, D.J. Bosman

SEROLOGIESE STUDIES/SEROLOGICAL STUDIES

(A)VS-Pr.38/1: Bereiding van bloedgroepreagente en immunologiese studies by plaasdiere, laboratoriumdiere en verwante spesies: Bereiding van beesbloedgroepreagente vir roetinetoetse en navorsing. 1967. S.J. du Plessis

(A)VS-Pr.41/3: Verwantskapstudies van bloed- en serumfaktore (geneties) met ekonomiesbelangrike produksie- en reproduksie-eienskappe by plaasdiere en verwante spesies: Serologiese en proteïenpolimorfe genetiese merkers en hulle verband met produksie-eienskappe by vleisbeeste. 1971. E.H.H. Meyer, C.Z. Roux

SIEKTES - BAKTERIEë/DISEASES - BACTERIA

OP-BACT.59: Praktiese metode vir die massaproduksie van *Campylobacter fetus*. 1976. A.D. Botha

SIEKTES - INSEKTEPLAE/DISEASES - INSECT PESTS

OP-ENT.27: Biologie en beheer van die stalvlieg. 1977. B. Sutherland

SIEKTES - PROTOZOë/DISEASES - PROTOZOA

OP-PROT.24: Identify, distribution and transmission of *Theileria* spp. in South Africa. 1977. A.J. de Vos

SIEKTES - RICKETSIA/DISEASES - RICKETSIA

OP-PATH.41: Duur van immuniteit teen hartwater in beeste en die invloed van serum inhibeerdes daarop. 1976. J.L. du Plessis, J.D. Bezuidenhout

SIEKTES - VIRUSSE/DISEASES - VIRUSES

OP-PATH.40: Effek van Wesselsbronvirus op die dragtige koei en foetus. 1976. J.A.W. Coetzer, A. Theodoridis

SUIWELMIKROBIOLOGIE/DAIRY MICROBIOLOGY

(A)VS-Pr.28: Quality of milk or cream with regard to its bacteriological composition:

(A)VS-Pr.47: Cooling and transport of milk and cream:

47/1: - Performance tests on air eliminators for bulk milk collection. 1978. B. Joubert

(A)VS-Pr.59: Opberging en bemarking van kaas:

59/3: - Characteristics of an anomalous gas-forming organism isolated from cheese. 1975. J. Walthew

SUIWELKUNDE/DAIRY SCIENCE

(A)VS-Pr.18: Studie van die variasie van melk- en bottervetproduksie in Suid-Afrika:

18/1: - Bronne van genetiese variasie. 1965. G.P. Kühn

18/2: - Bronne van nie-genetiese variasie. 1965. G.P. Kühn

(A)VS-Pr.21/1: Studies oor melkaantekeningnavorsing: Bepaling van 'n maatstaf vir 'elite'-koeie. 1964. G.P. Kühn

(A)VS-Pr.30: Opberging en bemarking van botter:

30/9: - Metode vir die bepaling van diasetiel en asetoin in aromabotter. 1974. J.A. Nieuwoudt

(A)VS-Pr.32/6: Vervaardiging van kaas: Verkorting van die vervaardigingsproses van Cheddarkaas. 1978. J.H. Labuschagne, J.A. Nieuwoudt

32/8: - Study of the propionic acid bacteria in Gouda cheese. 1972. T.J. Britz

32/9: - Studies in verband met die insout van Goudakaas in pekeloplossing. 1972. G. Vaandrager

32/10: - Bakteriologiese samestelling van kommersiële suursels vir Goudakaasvervaardiging. 1978. J.F. Mostert

32/13: - Invloed van oorryping van melk op die bakteriese gehalte en kwaliteit van Goudakaas. 1977. J.C. Meurs

32/14: - Study of the Pediococci in South African Gouda cheese. 1973. Barbara Statina

(A)VS-Pr.46: Quality of milk or cream in respect of chemical composition:

46/1 - Photometric method (Milkotester) for determining the fat and protein content of milk. 1973. H. Lück

46/3: - Gehalte van die verskillende proteïenfraksies in melk onder sekere gekontroleerde kuddetoestande. 1974. D.J. de Lange

46/6: - Bepaling van aminosure met behulp van gaschromatografie 1975. D.J. de Lange

46/8: - Determination of the fat, protein and lactose content of 10-day preserved samples by means of the infra-red milk analyser. 1975. H. Lück

(A)VS-Pr.47: Cooling and trasportation of milk or cream:

(A)VS-Pr.52: Manufacture of butter:

52/1: - Manufacture of cultured cream butter. 1975. J.H. Labuschagne

(A)VS-Pr.53: Vervaardiging van gekonsentreerde melkprodukte:

53/1: - Hygienic quality of milk power. 1978. H. Lück, H.F. du P. Jordaan

53/2: - Vibrating tube method for the determination of the density of condensed milk. 1978. J.H. Labuschagne, J.C. Pelster, L.E. Smit

(A)VS-Pr.54: Vervaardiging van kultuur-, bevrore en gegeurde melkprodukte:

54/4: Study of the technology of starter culture manufacture and preservation. 1972. J.B. Kriel

54/7: - Bakteriofaagtipering van melksuurstreptococci. 1972. J.B. Kriel

54/9: - Taksonomiese studie van *Streptococcus diacetilactis* en die praktiese belang daarvan vir die suiwelbedryf. 1974. J.F. Mostert

54/10: - Kweek en hantering van kaassuurselkulture. 1975. J.B. Kriel, L.A. Wood

54/12: - Propionic acid bacteria strain selection by means of the amino acid and sugar composition of the cell wall. 1975. T.J. Britz, N.F. Jordaan

(A)VS-Pr.55:	Verwerking en vervaardiging van newe- en ander suiwelprodukte:
55/2:	- Tegniekstudies in die konsentrering van afgeroomde melk deur middel van ultrafiltrasie. 1972. J.H. Labuschagne
55/3:	- Aanwending van die herwonne bestanddele deur ultrafiltrasie in suiwelprodukte. 1972. J.H. Labuschagne, D.J. de Lange
55/4:	- Fermentasie van wei vir die produksie van proteine. 1978. J.J. Keller
55/5:	- Ontledingskontroletoetse gedurende ultra-filtrasie van melk en wei. 1978. J.A. Nieuwoudt, L.E. Smit
(A)VS-Pr.58:	Storage and marketing of milk and cream:
58/1:	- Increase in temperature of milk during delivery to consumers. 1970. J.H. Labuschagne
58/3:	- Identifikasie van spoorvormende bakterieë uit ultra-hoë temperatuur behandelde en gesteriliseerde melk. 1978. J.F. Mostert
58/4:	- Bakteriologiese gehalte van U.H.T. behandelde melk. 1978. H. Lück
(A)VS-Pr.59:	Opberging en bemarking van kaas:
59/2:	- Maatstawwe om die graad van rypheid van kaas te bepaal. 1975. J.A. Nieuwoudt
(A)VS-Pr.64/1:	Gebruik van suiwelprodukte by menslike voeding: Vergelykende studie van botter en margarien ten opsigte van hul vetsuurinhoud. 1972.
64/2:	Goedhouvermoë van bederfbare suiwelprodukte. 1978. H. Lück, J.F. Mostert
(A)VS-Pr.65/1:	Gesondheidsaspekte in die verbruik van suiwelprodukte: Bepaling van chloorbevattende insektemiddels in suiwelprodukte. 1972. D.J. de Lange
65/2:	- Mycotoxins in South African dairy products. 1978. H. Lück
N-Ce.123:	Economic and technical aspects of milk production on pastures in Natal:
123/3:	- Chemical composition and nutritive value of kikuyu (*Pennisetum clandestinum*) pasture throughout the grazing season in bioclimatic group III - Mistbelt. 1972. R.M. Bredon, J.H. du Toit
SW-UK.2/1:	Suiwelboerdery in Suidwes-Afrika: Melkproduksie by beeste onder semi-ekstensiewe toestande. 1968. C.H. Smit, G. Thomas

SUIWELSTUDIES - INSEKTEMIDDELS/DAIRYING - INSECTICIDES

(A)I-Pr.97/6:	Afbreking en vermindering van plaagbeheermiddelreste: Voorkoms en nablywing in suiwelprodukte van gechloreerde insektemiddels. 1975. Mareli Krause
(A)VS-Pr.45:	Hulpmiddels en geriewe in die produksie van melk of room. 1975

TEGNOLOGIE/TECHNOLOGY

*OK-Do.66/5:	Beef production in the Eastern Cape: New *in vivo* technique determining body composition. 1976. N.H. Casey

TELING/BREEDING

(A)VS-Pr.80:	Teling van melkbeeste: Seleksie en teling vir melkbaarheids- en melkkwaliteitseienskappe in 'n eksperimentele kudde. 1971. J.H. Hofmeyr, M.H. Neitz, C.Z. Roux
O-Av.8/5:	Improvement of beef cattle by breeding: Study of genetic environmental interactions in growth rate of Afrikaner cattle and relationship between gains during different periods. 1967. T.H. Kruger

54/2: - Invloed van voor- en naspeense voedingsbehandelings op die groei en markklaarheid van jong vleisrasbulle. 1971. C.J. Dreyer, W.R.F.J. le Roux, D..W. Eden,

W-Tk.5/1: Beesvleisproduksie in die Winterreënstreek: Ondersoek na voorspeense behandeling van vleisras- en vleisras x melkraskalwers vir vleisproduksie in die graanstreke van Suid-Kaap. 1972. C.J.J. Brand

VOEDING/NUTRITION

(A)VS-Pr.26/7: Stikstofmetabolisme by herkouers: Onderskeidingsvermoë van sekere beskikbare toetse vir kwaliteitsbepaling van melkvervangers. 1977. L.H.P. Liebenberg

26/8: - The influence of feed intake on the utilization of protein sources in the rumen and lower digestive tract in the milk goat. 1977. W.D. Basson, L.H.P. Liebenberg, P.J.K. Morgan

(A)VS-Pr.73: Doeltreffendheid van voerverbruik by plaasdiere:

73/8: - *In vivo* beraming van liggaamsamestelling by vleisbeeste. 1976. H.H. Meissner

73/9: - Doeltreffendheidsrangorde van groeiende vleisbeeste op 'n kragvoer- en 'n ruvoerrantsoen. 1976. H.H. Meissner, C.Z. Roux, H.S. Hofmeyr

(A)VS-Pr.74/4: Benutting van *Zea mays* deur herkouers: Mieliegebaseerde volledige suiwelrantsoene. met verskillende kragvoer : ruvoer verhoudings en grofheidsgrade. 1974. L.H.P. Liebenberg

H-Ps.214/2: Intensiewe beesvleisproduksie: Mieliemeelbyvoeding aan jong osse op somerveld. 1968. H.J. van der Merwe

H-Ps.232: Inkuiling en kuilvoervoeding:

232/7: - Mieliemeelaanvulling tot mieliekuilvoerrantsoene vir Friesosse en -bulle. 1970. D.J. Theunissen, R.J. Theunissen

232/9: - Kostebesparing op proteïenaanvulling vir jong beeste op mieliekuilvoerrantsoene. 1971. H.J. van der Merwe

232/10: - Ureum-lusernmeel aanvullings vir jong beeste op mieliekuilvoer. 1972. H.J. van der Merwe

232/13: - Kuilvoer in vergelyking met kragvoerrantsoene vir die vetmesting van speenkalwers. 1975. H.J. van der Merwe

H-Ps.242/1: Melkproduksiestelsels in die Hoëveldstreek: Aanvulling op beperkte gras-klawerweiding vir melkkoeie. 1973. W.C. Hugo

*N-Ce.115: Production and reproduction in beef cattle:

*115/10: - Proteïen en/of energieaanvulling van lakterende vleisbeeskoeie op somerveld. 1974. H.J. Meaker, S.F. Lesch

*115/12: - Fattening of steers on summer pastures. 1975. S.F. Lesch, P.E. Bartholomew

N-Ce.123/5: Economic and technical aspects of milk production from pastures in Natal: Utilization of urea by lactating cows when fed maize. 1977. C.D. Hamilton, R.M. Bredon

O-Gl.123/6: Doeltreffende benutting van natuurlike veld in die O.V.S.-streek: 'n Ondersoek na die fosforstatus van beeste op veldweiding van die sentrale O.V.S. 1978. B. Ferreira

O-Gl.125: Evaluering van die voedingswaarde van ruvoere en weidings:

*125/16: - Voedingswaarde van sorghumhooi, wat in verskillende verhoudings deur kragvoer aangevul word, vir melkproduksie van hoog- en laagproduserende Frieskoeie. 1973. J.R. van Zyl, M.H. Neitz, C.L. Hartman, L.C. Biel

O-Vh.70: Verhoging van vleisproduksie deur doelgerigte kruisteling:

*70/2: - Kruisteling met die Afrikanerkoei as basis met verskillende rasse van bulle onder twee intensiteite van produksie. 1967. A.H. Mentz, W.A. Coetzer

70/4: - Kruisteling met die Afrikanerkoei as basis met verskillende grootraam vleisrasse onder 'n semi-intensiewe stelsel van produksie. 1973. A.H. Mentz, R.T. Naudé, W.A. Coetzer

70/7: - Produksiepotensiaal van vroulike kruisings uit Afrikanerkoeie met verskeie grootraamrasse. 1976. A.H. Mentz, W.A. Coetzer, M.C. Basson, T.H. Strydom

VLEISPRODUKSIE/BEEF PRODUCTION

(A)VS-Pr.13: Beef from dairy cattle:

*13/4: - Investigation of possible breed: feed interaction in dairy, dual-purpose x dairy, and beef x dairy calves on liberal or limited milk feeding regimes. 1965. R.T. Naudé

(A)VS-Pr.76: Kwantitatiewe en kwalitatiewe vleisproduksiestudies:

*76/6: - Influence of breed, age and sex of cattle on certain beef quality characteristics. 1973. R.T. Naudé, J.H. Dreyer

76/7: - Ondersoek na sekere tegnieke vir die prestasietoetsing van jong bulle. 1973. J.J. Harmse, R.T. Naudé

76/8: - Development of the skeletal muscular system in male animals of different breeds of beef cattle. 1973. R.T. Naudé, J.H. Dreyer

76/9: - Karkasevaluering van jong suiwer- en kruisgeteelde Afrikanerosse geslag op vier liggaamsmassas. 1975. R.T. Naudé, A.H. Mentz

76/12: - Kwantitatiewe en kwalitatiewe vleisproduksiestudies: Produksie en reproduksie van kort skrotumbulle. 1977. R.T. Naudé, D. Visser

*H-B1.58/4: Vleisproduksie uit die melkkudde: Intensiewe speenkalfproduksie op veld. 1970. J. Reyneke

H-Ps.214: Intensiewe beesvleisproduksie:

214/1: - Doeltreffendheid van beesvleisproduksie tot op verskillende lewende massas. 1964. H.J. van der Merwe

214/3: - Proteïenbehoeftes van agtienmaandoud-osse gedurende die afrondingsfase. 1975. H.J. van der Merwe

214/4: - Doeltreffenheid van stygende energiepeile gedurende die afrondingsperiode van vleisbeeste. 1976. H.J. van der Merwe

O-Vh.70: Verhoging van vleisproduksie deur doelgerigte kruisteling:

*70/3: - Produksiepotensiaal van verskillende vroulike Afrikaner F1-kruisings gedurende hulle vroeë reproduktiewe leeftyd. 1972. A.H. Mentz, W.A. Coetzer

70/5: - Aanwending van verskillende vleisbeestipes (rasse) as manlike en vroulike teelmateriaal in suiwer- en kruisteelstelsels. 1976. A.H. Mentz, W.A. Coetzer, R.T. Naudé

T-Mr.6/1: Beesvleisproduksiestelsels vir die Transvaalse Bosveld: Geskikte rasse, kruise en teelstelsels vir die Soetbosveld. 1976. H.P. Eloff, C.J.F. Lüdemann, E.E. Lademann, D.L. Els

T-Ng.54: Produksievermoë van jong vleisbeeste op verskillende voedingspeile:

54/1: - Invloed van verskillende voedingspeile op die groei, produksie en reproduksie van vleisrasverse. 1971. C.J. Dreyer, D.W. Eden, W.R.F.J. le Roux

125/17: - Evaluering van die voedingswaarde van die natuurlike weiding van Vaalharts. 1974. E.A.N. Engels, B. Ferreira

OK-Do.55: Benutting van akkerbougewasse as dierevoeding:

55/7: - *Eragrostis curvula* (Ermelo) vir melkkoeie. 1971. S.W. Bosman

55/9: - Proteïen en ruvesel wisselwerking in 'n volledige blaarkopmeelrantsoen vir melkkoeie. 1973. S.W. Bosman

OK-Do.66/4: - Afronding van tollies op *Eragrostis curvula*-weiding en op veld. 1974. S.W. Bosman, J.H. I'ons

O-Vh.70/6: Verhoging van vleisproduksie deur doelgerigte kruisteling: Potensiaal van vroulike, kruisgeteelde diere uit Jersey moeders vir produksie van slagkalwers. 1976. A.H. Mentz, J.A. Vermeulen, M.C. Basson, J.E. Coetzee

T-Tw.23: Kuilvoerbenutting vir beesvleisproduksie in die Springbokvlakte: Verrykte babalakuilvoer vir die afronding van osse. 1967. J.J. Coetzee

W-Eb.93: Voeding en versorging van groeiende melkrasbeeste in Wes-Kaapland:

*93/6: - Vergelyking van die emmer- en kunsspeenvoedingsmetode by Fries- en Jerseykalwers op verskillende peile van afgeroomde melk. 1970. C.J.J. Brand

93/7: - Evaluasie van kalfgrootmaakstelsels in die George-Knysna area. 1978. C.J.J. Brand

93/8: - Invloed van speentegniek op die groei en ontwikkeling van vroeggespeende kalwers. 1978. C.J.J. Brand

W-Eb.104: Voeding van melkbeeste in die Winterreënstreek. 1976.

104/1: - Benutting van bytsoda-behandelde koringstrooi deur die lakterende melkkoei. 1977. J. de K. van Dyk

VOEDINGFISIOLOGIE/NUTRITION PHYSIOLOGY

O-Gl.125/24: Invloed van droging van monsters versamel met slukdermgefistuleerde diere op die verwantskap tussen *in vivo* en *in vitro* verteerbaarheid. 1977. E.A.N. Engels, B. Ferreira, L.C. Biel

VOORTPLANTING/REPRODUCTION

H-Ps.197/2: Verhoogde vrugbaarheid by vleisbeeste: Invloed van byvoeding op die vrugbaarheid van jong koeie. 1963. D.J. Theunissen, R.J. Theunissen

N-Ce.115: Production and reproduction in beef cattle:

115/1: - Influence of supplementary feeding and of early weaning on the performance of the heifer with her first calf and on the growth of her progeny. 1968. A.W. Lishman

115/2: - Influence of early or late summer calving and of supplementary feeding on the growth of the calf and the reproductive performance of the cow in the Thornveld of Natal. 1967. A.W. Lishman

115/3: - Influence of early or late spring calving and of supplementary feeding on the growth of the calf and the reproductive performance of the cow in the transitional Highland Sourveld. 1967. A.W. Lishman, A.D. Lyle

OK-Do.70: Reproduksiedoeltreffendheid van vleisbeeste in die Oos-Kaap:

70/1: - Invloed van aanvullende voeding op die naspeense groei en die reproduksie van vleisrasverse. 1971. S.W. Bosman

*70/2: - Invloed van die voeding van lêhenmis op die reproduksie van koeie. 1972. S.W. Bosman

*OP-REP.16: Synchronization of oestrus in beef cattle under ranching conditions. 1976. H.J. Bertschinger

SW-Uk.1: Verhoging van vrugbaarheid by beeste:

1/1: - Waarde van energiebyvoeding aan produserende koeie. 1969. P.S. van der Merwe, G. Thomas

1/2: - Ondersoek na dekseisoene vir beeste op die Sandveldnavorsingstasie. 1973. J. Smit, J.B. van de Vyver

1/3: - Puberteit en die effek van ouderdom van eerste paring op produksie-eienskappe by die Simmentaler. 1973. C.H. Smit, L.P. van Wyk

T-Mr.6/2: Beesvleisproduksiestelsels vir die Transvaalse Bosveld: Die byvoeding van 'n energie- en proteïenryke kragvoer aan kalwerkoeie op veldweiding. 1976. H.P. Eloff, C.J.F. Lüdemann, E.E. Lademan

BOKKE/GOATS

GESLAGSFISIOLOGIE/REPRODUCTIVE PHYSIOLOGY

(A)VS-Pr.39/7: Geslagsfisiologie van inheemse en uitheemse manlike diere in Suid-Afrika: Bevriesing van Boerboksemen. 1974. D. Visser

K-Gf.139: Geslagsaktiwiteite van die ooi:

139/1: - Geslagshormoonpeile gedurende die bronstigheidsiklus van die Angorabokooi. 1976. D. Wentzel

139/3: - Verwantskap tussen hormoonpeile van die Angoraboklam en die daaropvolgende reproduksiepotensiaal van die ooi. 1976. D. Wentzel

K-Gf.140: Geslagsaktiwiteit van die ram:

140/1: - Hormoonpeil van die Angorabokkram gedurende periodes van hoë en lae geslagsaktiwiteit. 1977. J.H.P. van der Merwe

TELING/BREEDING

K-Gf.104: Verbetering van die Angorabok deur teling:

104/1: - Seleksie vir vageienskappe en vrugbaarheid by die Angorabok. 1976. J.M.P. van der Merwe

VOEDING/NUTRITION

K-Gf.131/2: Kunsmatige byvoeding: Vetmesting van Angorabokke. 1976. G.A. Jacobs

K-Gf.138/4: Perinataleverliese by kleinvee: Invloed van die peil van energie- en proteïenvoeding op perinataleverliese, laktasie en groei van lammers by Angorabokke. 1976. L. de W. Louw

VOORTPLANTING/REPRODUCTION

K-Gf.138: Perinatale verliese by kleinvee:

138/1: - Endokrinologiese studies van aborsie by Angorabokke. 1973. D. Wentzel

138/2: - Invloed van energievoeding op aborsie by die Angorabok. 1975. D. Wentzel

138/3: - Invloed van koue op aborsie by Angorabokke. 1976. D. Wentzel

KLEIN DIERTJIES/SMALL ANIMALS

TELING/BREEDING

(A)VS-Pr.103: Breeding and maintenance of small animals for experimental purposes:
- 103/1: Investigation into breeding techniques and the suitability of various species for biological research. 1976. Z. Earl

(A)VS-Pr.104: Gebruik van laboratorioriumdiere as biologiese modelle vir diereteeltprobleme:
- 104/1: Kwantifisering van groei en doeltreffendheid van voerverbruik vir seleksiedoeleindes by *Rattus domesticus*. 1977. M.M. Scholtz

KLEINVEE/SMALL STOCK

MOLEKULêRE BIOLOGIE/MOLECULAR BIOLOGY

OP-MOL.42: Studie van die nie-kapsied proteïene in bloutongvirus-besmette selle. 1976. H. Huismans, C.W. Bremer

OP-MOL.43: Further biochemical and genetic studies of temperature-sensitive mutants of blue tongue virus. 1977. S.O. Shipman

SIEKTES - VIRUSSE/DISEASES - VIRUSES

OP-PATH.39: Patologiese en virologiese studies op Wesselsbronsiekte in volwasse skape en bokke. 1976. J.A.W. Coetzer, A. Theodoridis

OP-VIR.46: Application of the fluorescent antibody technique for the diagnosis of Wesselsbron and Rift Valley fever viruses. 1976. R.H. Murray, A. Theodoridis

VOEDING/NUTRITION

K-Gf.141/1: Model vir die bepaling van die voedingsbenodigdhede van kleinvee in die Karoo. 1977. O. Bosch

PERDE/HORSES

TELING/BREEDING

T-Ng.16: Nooitgedacht indigenous saddle-horse stud. 1951. D.W. Eden

SKAPE/SHEEP

BEDRYFSONDERSOEK/ENTERPRISE INVESTIGATION

O-Ut.40: Verbetering van algemene bestuurspraktyke in Karakoelboerdery:
- 40/1: Vergelyking tussen droogbewerkte en gewasde pelse as metode vir voorbereiding vir die mark. 1976. G.J. Minnaar, D.A. Boshoff

BESTUUR/MANAGEMENT

W-Lg.12: Skaapbestuurspraktyke in die Winterreënstreek:
- *12/1: Evaluasie van vroegspeenpraktyke met die oog op intensivering van skaapboerdery in die Swartland. 1969. T.T. de Villiers
- 12/3: Versnelde paringsfrekwensie by skape in die Winterreënstreek. 1973. L.S. Erasmus

GESLAGSFISIOLOGIE/REPRODUCTIVE PHYSIOLOGY

(A)VS-Pr.39:	Geslagsfisiologie van inheemse en uitheemse manlike diere in Suid-Afrika:
*39/4:	- Puberteit by Merino-, Dorper-, Persie- en Namakwaramme. 1970. D. Visser
39/6:	- Invloed van bevriesing van Karakoelramsemen op die vrugbaarheid van die sperma. 1971. D. Visser
*39/8:	- Effek van verdunning, bewaring by 5 °C en vervoer op motiliteit en bevrugtingsvermoë van Gotlander semen. 1971. D. Visser
K-Gf.101:	Verband tussen die intensiteit van wolproduksie en die geslagsaktiwiteite van Merino-ooie. 1962. W.J. Hugo
K-Gf.139/2:	Geslagsaktiwiteit van die ooi: Geslagshormoonpeile gedurende die bronstigheidsiklus van die Merino-ooi in die herfs en lente. 1976. D. Wentzel
O-Gl.140:	Geslagsfisiologiese studies met wolskape:
O-Ut.32:	Geslagsfisiologiese studies met skaaprasse:
*32/12:	- Tyd van ovulasie van lakterende Karakoelooie na sinchronisasie van die estrussiklus met progestogeen en DMS. 1974. D.A. Boshoff
O-Ut.39/1:	Intensifisering van kleinvee-reproduksie: Vergelyking van die intravaginale spons en onderhuidse implantaat op Karakoelooie t.o.v. hul effektiwiteit van sinkronisasie en potensiaal om reproduksie te verhoog. 1976. A.S. Faure
SW-Kh.1/8:	Reproduksiestudies met Karakoelskape: Bepaling van die tyd van ovulasie by Karakoelooie. 1972. L.C. van Wyk, P.J. le Roux
SW-Nd.1/4:	Invloed van voeding op die reproduksie-eienskappe: Invloed van speenouderdom op groei en puberteit van Karakoellammers en herbesetting van die ooie. 1971. P.J. le Roux

LAB-TEGNIEK/LAB TECHNIQUE

*OP-DMR.50:	Accurate determination of propionate in ovine blood. 1975. J.G. van der Walt

MOLEKULêRE BIOLOGIE/MOLECULAR BIOLOGY

*OP-MOL.42:	Protein synthesis in bluetongue virus infected cells. 1976. H. Huismans
OP-MOL.44:	Invloed van gloxazone op die immuniteit van skape teen hartwater. 1978. J.L. du Plessis

OORWINTERING/WINTERING

N-Ce.112:	Oorwintering van skape in die Natalse misgordel:
112/3:	- Inkuiling van kikoejoe vir wintervoeding van skape. 1970. S.F. Lesch, B.P. Louw
OK-Do.64:	Oorwintering van lammerooie in die suurgrasveld van die Oos-Kaapstreek:
64/8:	- Invloed van veldkwaliteit en hoë proteïenaanvulling op die produksie van lammerooie. 1972. H.H. Barnard

PELSEIENSKAPPE/PELT CHARACTERISTICS

(A)VS-Pr.81:	Histologiese ondersoek na voorgeboortelike follikel- en haarontwikkeling by die Karakoellam. 1972. J.H. Dreyer

SIEKTES - VERGIFTIGING/DISEASES - POISONING

(A)PS-Pr.35: Studies oor toksigene swamme in veevoere:

*35/1: - Lupinose by skape. 1970. G.C.A. van der Westhuizen, Cecilia Roux

OP-PATH.51: Die ultrastrukturele patalogie; patogenese chemiese patologie en haematologie in pasgebore lammers besmet met Slenkdalkoors. 1978. J.A.W. Coetzer, A. Theodoridis

OP-TOX.16: Lupinose II: Die giftige metaboliteit van *Phomopsis leptostromi formis* (Kuhn) Bibak. 1970. C.H. van Aswegen

SIEKTES - VIRUSSE/DISEASES - VIRUSES

OP-PATH.42: Effect of Wesselsbronvirus on the pregnant vervet monkey and its developing fetus. 1977. A.F. van Dellen, J.A.W. Coetzer, A. Theodoridis, A. De Vos

STELSELONTLEDING/SYSTEM ANALYSIS

OK-Bh.44/1: Production systems in the Eastern Cape: Intensive sheep production system, Bathurst. 1976. F.O.C.W. Karberg

TELING/BREEDING

(A)VS-Pr.89: Berekening van produksieparameters van belang by veekunde:

*89/2: - Ondersoek na die optimale gebruik van prestasietoetsing in die lig van die teelstruktuur van die Suid-Afrikaanse Merino. 1975. G. Erasmus

K-Gf.72: Vergelyking van verskillende seleksiemetodes met Merinoskape. 1962. J.M. Cloete

K-Gf.75: Gelyktydige tweerigting seleksie vir die eienskappe, wolkwaliteit en wololie by Merinoskape. 1962. J.E. Nel

K-Gf.105: Halfklas-vaggewigstelsel as seleksiemetode by Merinoskape. 1965. J.A.A. Baard

K-Gf.128/1: Rasveredeling: Seleksie vir vleisproduksie en vrugbaarheid by Dorperskape. 1977. P.G. Marais

K-Kn.5: Ontwikkeling van 'n witwol-vleisskaap vir die ekstensiewe skaapweistreke. 1969. P.G. Marais

O-Kf.19/1: Teling van vleisskape: Seleksiestudies met Dorperskape. 1966. C.F. Sievers, J.H. Hofmeyr, C.Z. Roux

O-Ut.38: Teelstudies met Karakoelskape:

38/1: - Ontwikkeling van 'n spesifieke grysbruin en silwerpuntige sjokoladebruin pels by Karakoelskape. 1962. D.A. Boshoff

38/2: - Seleksielyne by karakoelskape. 1963. D.J. Gouws

38/5: - Effek van kruisteling op sekere kwantitatiewe en kwalitatiewe eienskappe. 1972. D.A. Boshoff

OK-Bh.38: Teling van 'n wolvleisskaap en die inpassing daarvan by die bestaande boerderypraktyke van die kusstreek. 1959. F.O.C.W. Karberg, H.H. Barnard

OK-Do.6: Ontwikkeling van 'n wolvleisskaap vir die suurgrasvelddele van die Oos-Kaapstreek. 1949. H.H. Barnard

SW-GO.1: Erflikheidsberamings by Karakoelskape:

1/2: - Ondersoek na die metaalagtige glans by Karakoellammers. 1966. P.H. Hugo

SW-GO.1/3:	- Oorerwing van pigmentlose hare by Karakoellammers. 1967. P.H. Hugo
1/4:	- Seleksie vir maksimum en minimum krulontwikkeling by Karakoelskape. 1967. P.H. Hugo
SW-GO.2:	Kleurteling by Karakoelskape:
2/1:	- Teling van grys Karakoelskape. 1973. G.J. van Zyl, D. Kotze
2/2:	- Ontwikkeling van 'n resessiewe wit kleur by die Karakoel. 1973. G.J. van Zyl, D. Kotze
2/3:	- Ontwikkeling van 'n dominante wit kleur by die Karakoel. 1973. G.J. van Zyl, G.J. Agenbag
SW-Nd.3/1:	Intelingstudies by Karakoelskape: Effek van inteling op verskillende eienskappe by Karakoelskape. 1967. P.H. Hugo
SW-Wk.2/1(K):	Opgraderingstudies by Karakoelskape: Waarde van die wit Karakoel in 'n opgraderingsprogram. 1971. G.J. van Zyl
T-Ng.52:	Intensiewe skaapproduksie:
52/1:	- Evaluering van die Merino en sy F1-kruisings. 1969. L. Ueckermann, L. Bouwer
52/2:	- Evaluering van verskillende Merino F1-kruisings as moederooie vir tweede-stadium kruisings. 1969. L. Ueckermann, L. Bouwer
52/3:	- Evaluering van verskillende Merino F1-kruisings met behulp van die resiproke kruisingstegniek. 1969. L. Ueckermann, L. Bouwer
*W-Eb.2:	Ontwikkeling van 'n vetlamras. 1940. I.L. Ferreira, L.S. Erasmus

VLEISPRODUKSIE/MUTTON PRODUCTION

(A)VS-Pr.39/9:	Effect of short scrotum castration on the growth efficiency, fertility and meat production of Merino-type crossbred lambs. 1977. D. Visser
H-Ps.225:	Intensiewe vleisproduksie van woldraende skape:
225/3:	- Byvoeding op somerveld vir die afronding van ou ooie. 1967. D.J.Theunissen
225/6:	- Afronding van skape op rantsoene met hoë kosentrasie mielieblaarkopmeel. 1970. P.J. Boshoff, H.J. van der Merwe
225/8:	- Invloed van die proteïeninhoud van aanvullende konsentrate vir vroeggespeende lammers op wintergraanweiding. 1974. A.J. van Heerden
H-Ps.232/17:	Inkuiling en kuilvoervoeding (17) Verbetering in karkasgradering en winsgewendheid van slaglammers d.m.v. gedifferensieerde energie- en proteienaanvullings tot mielies. 1977. P.J. Boshoff
K-Gf.128/2:	Rasverdeling: Liggaamsamestelling van Dorperksape. 1976. P.G. Marais
N-Ce.136:	Intensiewe slaglamproduksie in Natalstreek:
136/1:	- Vergelyking van drie stelsels vir die hoë reënvalstreke. 1974. J. Grobbelaar
O-Gl.140:	Geslagsfisiologiese studies met wolskape:
140/3:	- Slaglamproduksiepotensiaal van ou Merino-ooie onder intensiewe toestande. 1975. D.W.G. Swart, O.P.J. Steyn
W-Nt.4:	Vergelyking van die groei- en slagprestasie van ooie en gekastreerde en ongekastreerde Duitse Merinolammers op die natuurlike weiding van die Nortierproefplaas. 1968. D.G.F. Labuschagne
W-Sb.142/1:	Slaglamproduksie in die Winterreënstreek: Slaglamproduksie in die Suid-Kaap. 1972. L.S. Erasmus

VOEDING/NUTRITION

(A)VS-Pr.26:	Stikstofmetabolisme by herkouers:
*26/2:	- Ondersoek na faktore wat metaboliese misstikstofuitskeiding bepaal. 1970. H.S. Hofmeyr
26/6:	- Use of starea as only nitrogen supplement in a production diet. 1977. W.D. Basson
26/9:	- Efect of ammonia concentration in rumen fluid on the flow of crude protein to the duodenum. 1977. P.J.K. Morgan, W.D. Basson, E.B. Spreeth
(A)VS-Pr.73:	Doeltreffendheid van voerverbruik by plaasdiere:
73/4:	- Ondersoek na dierevariasie ten opsigte van vrywillige voerinname by skape. 1974. H.H. Meissner
73/5:	- Gelyktydige meting van die verskillende komponente van die energiehuishouding by groeiende lammers. 1975. H.S. Hofmeyr
*73/6:	- Stikstofneerleggingspotensiaal by verskillende skaaptipes. 1972. H.H. Meissner
73/7:	- Bevestiging van 'n nuwe groeiteorie. 1975. H.H. Meissner, C.Z. Roux, H.S. Hofmeyr
(A)VS-Pr.93:	- Evaluation and improvement of energy supply in low quality roughages and by-products available for ruminant nutrition in South Africa:
93/3:	- Intake and parameters related to the partial digestion of NaOH treated kikuyu in lambs. 1975. P.J.K. Morgan, J.P. Pienaar
93/4:	- Waarde van NaOH-behandelde koringstrooi in terme van mieliemeel in groeirantsoene vir lammers. 1976. T.H. Jansen, H.S. Hofmeyer
H-Ps.196/11:	Benutting van lae-proteïen ruvoere deur herkouers: vergelyking van verskillende proteïen- en stikstofbronne as aanvulling tot lae-proteïen hooi vir liggaamsonderhoud van skape. 1966. P.J. Boshoff, D.J. Theunissen
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H-Ps.232:	Inkuiling en kuilvoervoeding:
232/1:	- Benutting van mieliekuilvoer van plante op twee groeistadia ingekuil met en sonder byvoeging van kalk, ureum en biuret. 1967. J.W. Cilliers
232/4:	- Byvoeging van melasse, mieliemeel en ureum by inkuiling op die kwaliteit van mieliemeel en ureum by inkuiling op die kwaliteit van mieliekuilvoer. 1969. C.W. Cruywagen
*232/11:	- Vergelyking tussen mieliekuilvoer, stoekmielies en ryp mielieplante. 1973. H.J. van der Merwe
*232/14:	- Energie-aanvulling tot mieliekuilvoer vir slaglamproduksie. 1975. P.J. Boshoff
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K-Gf.89/11:	Kunsmatige en byvoeding van skape in die Karoostreek: Invloed van die kragvoer:ruvoerverhouding van die rantsoen op die vetmesting van ou Merinoskape. 1967. F.C. Hayward
K-Gf.115/4:	Studies oor droogtevoeding van skape in die sentrale Karoo: Effek van voedingspeil op die produksie en reproduksie van merino-ooie. 1969. J.G. Cloete

K-Gf.129: Voedingswaarde van Karooweidings:

K-Kn.3/1: Droogtevoedingstudies met skape in die noordwestelike Karoo: Vasstelling van moontlike energie- en/of proteïentekorte van verskillende veldsoorte. 1966. J.G. Cloete

N-Ce.105: Feeding of sheep on artificial grazing in the mistbelt of Natal:

- 105/2: - Effect of the moisture content of kikuyu herbage on its utilization by sheep. 1971. S.F. Lesch
- 105/5: - Relationship between animal production and the chemical composition of acceptable and unacceptable mechanically harvested kikuyu grass. 1973. J.P. Marais, S.F. Lesch, I. Rottcher

N-Ko.4/5: Investigation of the advantages and problems associated with spring and autumn mating of ewes in East Griqualand: Nutrition of the autumn lambing ewe six weeks before lambing. 1976. A.D. Lyle, G.J. Muller

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O-Gl.125: Evaluering van die voedingswaarde van ruvoere en weidings:

- 125/6: - Voedingswaarde van bemeste en onbemeste hooie vir skape. 1965. J.A. Swart, E.A.N. Engels, B. Ferreira
- 125/8: - Droëmateriaalinname van vryweidende skape op veldweidings. 1966. E.A.N. Engels, A. van Schalkwyk, A. Malan, B. Ferreira
- 125/15: - Bepaling van die voedingswaarde van sekere aangeplante winter- en somerweidings vir skape. 1969. E.A.N. Engels, J.A. Swart, A. Malan, B. Ferreira
- 125/18: - Evaluering van die voedingswaarde van veldweiding van Koopmansfontein. 1973. E.A.N. Engels, B. Ferreira
- 125/23: - Invloed van proteïenaanvulling deur die jaar op die selektiewe weigewoonte en voerinname van vryweigewoonte en voerinname van vryweidende skape. 1977. H.O. de Waal, E.A.N. Engels, L.C. Biel

*OK-Do.54/2: Voedingstudies met Merinotipe skape onder ingekraalde toestande: Studies van die produksie- en reproduksiepotensiaal van skape onder intensiewe toestande. 1967. H.H. Barnard

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OP-NUT.12: Effek van sulfaat in die drinkwater van skape. 1977. J. de V. du Toit, E.L. Barrett

W-Lg.12: Skaapbestuurspraktyke in die Winterreënstreek:

W-Tk.3/9: Evaluasie van weidingsgewasse en skaapbestuurspraktyke in die Winterreënstreek: Studie van mineraaltekorte en -aanvullings by skape op aangeplante weidings in George-omgewing. 1977. N.M. Kritzinger

VOORTPLANTING/REPRODUCTION

OK-Do.64/7: Wintering of wet ewes in the sour grassveld of the Eastern Cape Region: Effect of feeding laying hen manure on the reproduction of ewes. 1970. S.W. Bosman

OP-PATH.50: Teratology in sheep associated with the treatment of pregnant ewes with parbendazole. 1978. L. Porzesky, J.P.J. Joubert

SW-Kh.1: Reproduksiestudies met karakoelskape:

1/1: - Ondersoek na dekseisoene by karakoelskape op die kalahariproefplaas. 1965. P.J. le Roux, G.J. Agenbag

1/9: - Langtermyn effek van vervroegde partus by die Karakoelooi. 1974. L.C. van Wyk, J.M. Smith

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WOL - HISTOLOGIE/WOOL -HISTOLOGY

T-Ng.52: Intensiewe skaapproduksie:

52/4: - Histologiese evaluasie van vel en vesel by ouerrasskape. 1971. J.H. Dreyer, M.R. Schwellnus

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WOL - KWALITEIT/WOOL - QUALITY

K-Gf.118: Gehaltestudies by wol:

118/2: - Verwering van wol geproduseer in verskillende boerderygebiede van die Karoostreek. 1976. J.J. Venter

118/4: - Gehalteverskille tussen ondergekartelde, Duerdengetroue en oorgekartelde wol. 1978. P.D. Grobbelaar

WOLTEGNOLOGIE/WOOL TECHNOLOGY

K-Gf.118/3: Gehaltestudies by wol: Fisiese en chemiese eienskappe van wol van goeie en swak kwaliteit. 1970. J.J. Venter

VARKE/PIGS

BEDRYFSONDERSOEK/ENTERPRISE INVESTIGATION

(A)VS-Pr.42: Voeding en versorging van die jong varkie:

42/2: - Invloed van speenouderdom van 'n sog se werpsels op haar lewensproduktiwiteit. 1970. E.H. Kemm

GESLAGSFISIOLOGIE/REPRODUCTIVE PHYSIOLOGY

(A)VS-Pr.100: Reproduction potential of the prepubertal gilt. 1977.

100/1: - Influence of method of blood collection from gilts on their sex and corticosteroid hormone levels. 1977. A.R. Gee

100/2: - Effect of season, birth and related factors on the incidence of puberty in gilts. 1977. A.R. Gee, D. Visser, Erna Dierkse

VARKE

SIEKTES - BAKTERIEë/DISEASES - BACTERIA

*(A)VS-Pr.35/3: Elektroforetiese en ander chemiese-fisiese studies op plaasdiere en verwante spesies (genetiese polimorfisme): Elektroforetiese studies in verband met roetine toetse by varke. 1967. E.H.H. Meyer

*(A)VS-Pr.36/3: Bestudering van genetiesbeheerde serologiese en biochemiese polimorfisme by plaasdiere, laboratoriumdiere en verwante spesies: Klassifikasie van Suid-Afrikaanse varkrasse - bloedgroepe by varke. 1970. E.H.H. Meyer

*(A)VS-Pr.38/3: Bereiding van bloedgroepreagente en immunologiese studies by plaasdiere, laboratoriumdiere en verwante spesies: Bereiding van bloedgroepreagte vir roetinetoetse by varke. 1967. E.H.H. Meyer

(A)VS-Pr.41/2: Verwantskapstudies van bloed- en serumfaktore (geneties) met ekonomiese belangrike produksie- en reproduksie-eienskappe by plaasdiere en verwante spesies: Immunogenetiese en serologiese merkers en hulle verband met produksiefaktore by varke. 1967. E.H.H. Meyer

VOEDING/NUTRITION

(A)VS-Pr.67: Evaluering en standardisering van varkrantsoene onder Suid-Afrikaanse toestande.

67/3: Invloed van rantsoen-energiekonsentrasie, gevoer teen 'n voldoende proteïeninhoud, op die groeitempo, liggamsamestelling en voedselkomponentbenutting by groeiende varke. 1975. E.H. Kemm

67.42: Voeding en versorging van die jong varkie:

(A)VS-Pr.67: Evaluering en standardisering van varkrantsoene onder Suid-Afrikaanse toestande:

67/3: - Invloed van rantsoen-energiekonsentrasie, gevoer teen 'n voldoende proteïeninhoud, op die groeitempo, liggaamsamestelling en voedselkomponentbenutting by groeiende varke. 1975. E.H. Kemm

67/4: - Kwantifisering van die effekte van nat teenoor droë voeding op die groeiende vark. 1976. F.K. Siebrits

(A)VS-Pr.87/3: Chemiese en biologiese evaluasie van proteienbronne: Gebruik van hoë lisienmielies in varkgroeimele. 1976. E.H. Kemm, G.A. Smith

87/4: - Bepaling van optimale insluitingspeile van sonneblomoliekoekmeel in varkgroeidiëte. 1978. F.K. Siebrits, E.H. Kemm, G.A. Smith, M.N. Ras

W-Eb.101: Voeding en behuising van varke in verskillende lewens- en produksiestadia in die Winterreënstreek:

101/1: - Invloed van rantsoene met verskillende peile van geoksideerde en ongeoksideerde vismeel op die smaak van varkvleis. 1968. G.N. van Wyk

*101/2: - Minimum-kosterantsoene by varkvoeding. 1972. G.N. van Wyk

*101/3: - Evaluering van triticale as 'n voergewas vir groeiende varke. 1975. L.R.A. Horsten

WILD/GAME

PRODUKSIE/PRODUCTION

SW-Om.1/1: Wildinskakeling by ekstensiewe veeboerdery: Produksiepotensiaal van sekere wildsoorte op die Omatjenneproefplaas. 1970. J.P. van Niekerk, J.A.J. van Eck

Plaasvoëls/Farm Birds

ALGEMEEN/GENERAL

SIEKTES - INWENDIGE PARASIETE/DISEASES - INTERNAL PARASITES

*OP-POUL.9: Bepaling van die Antimikrobiese middelgevoeligheid van *Escherichia coli* uit pluimvee en omgewing geïsoleer. 1977. S. Buys, L. Coetzee

*OP-POUL.19: Toxicity of levamisole as a parenteral treatment for birds. 1976. S.B. Buys, H.N. van der Made

EENDE/DUCKS

VOEDINGSWAARDE/NUTRITIONAL VALUE

(A)VS-Pr.92/2: Suitability of a Hagedoorn breeding programme for improving productivity in Pekin ducks: Rearing ducks on a controlled feed intake-regime and the result on their subsequent productive performance. 1974. M.D. Olver

GANSE/GEESE

VOEDING/NUTRITION

(A)VS-Pr.91/1: Nutritional requirements for growth of Chinese geese: Requirements in respect of proteins, fibre and energy. 1965. M.D. Olver

HOENDERS/FOWLS

SIEKTES - BAKTERIEë/DISEASES - BACTERIA

OP-BACT.60: Vergelyking van lewendige en geïnaktiveerde *Salmonella gallinarum* entstowwe. 1977. C.M. Cameron, S.B. Buys

TELING/BREEDING

(A)VS-Pr.82: Teling en verbetering van pluimvee vir eierproduksie:

82/1: - Teling van voortreflike lêrasse met geslasgekoppelde veerkleur. 1970. C.L. Marais

82/2: Teling van voortreflike lêrasse met rooi en goud veerkleur. 1970. C.L. Marais

82/3: - Genetiese kombineervermoë van hoenderrasse en bloedlyne. 1970. W.C. Viljoen, C.L. Marais, J.J. Joubert

82/4: - Teling en seleksie van die Australorp vir eierproduksie en -gehalte. 1967. C.L. Marais

82/5: - Teling van die Minorca-hoenderras as 'n bron van genetiese materiaal. 1970. C.L. Marais

82/7: - Teling van 'n voortreflike outoseks hoenderras. 1973. C.L. Marais, J.J. Joubert, J.J. Gregorowski

82/8: - New Hampshire genetiese kontrole trop. 1976. J.J. Joubert

(A)VS-Pr.96: Kwantitatiewe oorerwing by pluimvee:

96/1: - Genotipe omgewingswisselwerking. 1975. J.J. Joubert, J.J. Gregorowski

(A)VS-Pr.97: Teling en verbetering van slagpluimvee:

97/1: - Teling van braaikuiken haanlyne. 1962. J.J. Joubert

97/2: - Teling van braaikuiken henlyne. 1962. J.J. Joubert

97/3: - Braaikuiken haanlyn genetiese kontroletrop. 1975. J.J. Joubert

97/4: - Braaikuiken henlyn genetiese kontroletrop. 1975. J.J. Joubert

VOEDING/NUTRITION

(A)VS-Pr.98: Voeding van pluimvee:

98/1: - Invloed van verskillende peile van vismeel op die eierproduksie van lêhenne. 1976. J. Erasmus

98/2: - Invloed van beperkte voerinname op eierproduksie, karkassamestelling en gehalte van eiers van eiertipe henne. 1977. L.J. Steenkamp, J. Erasmus

98/3: Die voeding van pluimvee: Effek van lêrantsoene met verskillende peile van fosfor op aantal, grootte en gehalte van eiers. 1977. J.Erasmus, J.J. Gregorowski

98/4: - Effek van groei en lêrantsoene met verskillende peile van energie en proteïen op die prestasie van lêhenne. 1975. J.H. de Jongh

98/5: - Verteerbaarheid van metionien in vismeel. 1976. D.R. Barnard

VOLSTRUISE/OSTRICHES

BESTUUR/MANAGEMENT

W-Sb.144/3: Volstruisproduksie: Invloed van die volstruis as weidende dier op lusern. 1973. C.J. Nel

PRODUKSIE/PRODUCTION

W-Oh.8: Kuddegemiddelde- en produksierekords binne 'n geslote volstruispopulasie:

8/2: - Ondersoek na die variasie in getal vlerkpluime (witvere) by volstruise. 1976. D. Swart

8/3: - Volstruisvelle en leerkwaliteit. 1977. D. Swart

W-Sb.144: Volstruisproduksie:

144/2: - Situasiebepaling. 1973. C.J. Nel

144/4: - Dosering van volstruise. 1974. C.J. Nel

*144/6: - Kuikenmortaliteit. 1976. C.J. Nel

SELEKSIESTUDIES/SELECTION STUDIES

W-Oh.8: Kuddegemiddelde- en produksierekords binne 'n geslote volstruispopulasie:

8/1: - Kuddegemiddeldes binne 'n geslote volstruispopulasie, interpretasie daarvan en beraming van moontlik genetiese parameters vir toekomstige nageslag. 1974. D. Swart

8/4: - Studie van sekere veereienskappe by volsruise. 1978. D. Swart

VOEDING/NUTRITION

*W-Sb.144/1: Volstruisproduksie: Ruveselvertering. 1972. C.J. Nel

DIERKUNDE/ZOOLOGY

OMGEWINGSBESOEDELING/ENVIRONMENTAL CONTAMINATION

(A)I-Pr.111: Omgewingsbeoedeling deur plaagbestrydingsmiddels:
    111/4: - Toksisiteit van sekere plaagdoders vir kommersieële vis. 1975. C.G. Greef
    111/8: - Nablywing van plaagbeheermiddels in landbouingrond. 1975. L.P. van Dyk

EKONOMIE /ECONOMY

EKONOMIESE STUDIES/ECONOMIC STUDIES

W-Vl.17/35: Bevordering van landbouproduksie in die Winterreënstreek: Wyndruiwe ekonomiese norme. 1977. G.G. van der Merwe

GRONDE/SOILS

BEMESTING/FERTILIZERS

N-Ce.106/30: Amelioration of acidity in a Farmingham clay loam and establishment of lime requirement indices for maize. 1976. M.P.W. Farina, P. Channon

(S)WP.229/2: Grondkundige studies in verband met kern- en steenvrug en tafeldruifverbouing in die Winterreëngebied: Faktore wat die omsetting en vervlugtiging van verskillende stikstofvorme in die grond beïnvloed. 1977. M. du Preez

T-Rp.26: Invloed van aluminiumtoksisiteit en fosfaatvaslegging op die benuttingsmoontlikhede van suurgronde in die Transvaalstreek:

T-Rp.28: Bemestings- en bekalkingsbehoeftes van die gronde van die Transvaalstreek:
    28/1: - Koöperatiewe bemestings- en bekalkingsproewe in samewerking met die voorligtingsdiens. 1970. W.J. Conradie
    28/3: - Roetine grondontledingsdiens en bemestingsaanbevelings aan boere in die Transvaalstreek. 1971. W.J. Conradie

W-Sb.149: Kalibrering van chemiese grondontledingsmetodes vir diagnostiese doeleindes:
    149/1: - Studie van die korrelasie tussen chemies ekstraheerbare fosfor en fosforopname deur verskeie gewasse. 1974. G.R. Thompson
    *149/2: - Ondersoek na neutraliseringseffektiwiteit van verskillende maasgroottes van 'n skulpkalk. 1975. C.P. de L. Beyers

BESPROEIING/IRRIGATION

(A)S-Pr.45/2: Ameliorasie van grond en water vir beter benutting onder besproeiingstoestande in Suid-Afrika: Bepaling van die waterkwaliteit van Suid-Afrika se oppervlakwaterbronne met behulp van beskikbare inligting. 1972. H.M. du Plessis

(A)S-Pr.52: Wiskundige grondmodelle vir die bestudering van hidrosoutvloeistelsels:
- 52/1: Die Vis- en Sondagsrivieropvang- en besproeiingsgebiede. 1975. P.C. van Rooyen, J.N. de Bruyn, T.E. Dohse, H.M. du Plessis, H.C.H. Hahne, J.L. Hutson

N-Ce.127: Factors affecting the irrigation potential of Natal soils:
- *127/1: Survey of the quality of irrigation water in the Natal Region. 1972. A. Cass
- 127/2: Examination of techniques currently available for the appraisal of salinity and alkalinity. 1972. A. Cass
- 127/3: Effect of irrigation water on Makatini soils. 1972. A. Cass

BODEMOPNAMES/SOIL SURVEYS

(A)S-Pr.4: Bodemopnamedienste vir besproeiingsdoeleindes:
- 4/14: Intensiewe bodemopname van die Oranjerivier-besproeiingsprojek. 1965. T.E. Dohse, C.N. MacVicar
- 4/15: *Ad hoc* surveys for purposes related to irrigation. 1972. C.N. MacVicar, T.E. Dohse

(A)S-Pr.6: Classification and mapping of the soils of the Republic of South Africa:
- 6/13: Soil survey of Villiers (1:50 000 topocadastral sheet Grootvlei 2628DC). 1965. E. Verster, C.N. MacVicar
- *6/22: Preparation for publication of the first edition of a national soil classification system. 1972. C.N. MacVicar
- 6/23: *Ad hoc* surveys for purposes other than irrigation. 1973. C.N. MacVicar, J.F. Eloff

(A)S-Pr.48: Inventorizing the terrain form and soils of South Africa with due consideration of climate:
- 48/1: Highveld Region. 1972. R.W. Bruce, C.N. MacVicar, J.F. Eloff
- 48/2: Eastern Cape Region. 1972. J.A.V. Dietrichsen, C.N. MacVicar, J.F. Eloff, A.L. Smith-Baillie
- 48/3: Orange Free State Region. 1972. J.F. Eloff, C.N. MacVicar
- 48/4: Natal Region. 1972. R.W. Fitzpatrick, J.F. Eloff, D.P. Turner, C.N. MacVicar
- 48/5: Transvaal Region. 1972. C.N. MacVicar, J.L. Schoeman, J.F. Eloff, B.C. Geers
- 48/6: Winter Rainfall Region. 1972. F. Ellis, B.H.A. Schloms, C.N. MacVicar, J.F. Eloff
- 48/7: Karoo Region. 1973. J.A.V. Dietrichsen, C.N. MacVicar, J.F. Eloff

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N-Ce.124/1:	Detailed soil surveys in the Natal Region: Soil survey of the Kokstad/Cedaraville area of East Griqualand. 1973. D.M. Scotney
OK-Do.84:	Grondondersoeke in die Oos-Kaapstreek:
84/1:	- Soil surveys of selected areas in the Upper Orange River catchment. 1976. M.O. Hartman
84/2:	- Erodibility of certain soil series in the Molteno district. 1976. M.O. Hartman

BRAKSTUDIES/SALINITY STUDIES

(S)N.95/1:	Herwinning van brakgronde vir die verbouing van subtropiese vrugte: Loging van braksoute. 1969. J. Conradie
(S)WP.212:	Vrugteverbouing onder braktoestande:
212/3:	- Evaluasie van brakbesproeiingswater vir sagtevrugte en tafeldruiwe. 1973. W.J. Pienaar
SW-Hp.1/1:	Verbetering van brakgronde in die Hardapgebied: Gebruik van ses primêre bewerkingsmetodes op brakgrond. 1967. G.S.P. Vink
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*139/1:	- Verbetering van grondvoghuishouding en algemene fisiese toestande van brak- en ander probleemgronde deur middel van verskillende herwinningsmateriale. 1972. P.C. van Rooyen

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(A)S-Pr.43:	Physical properties of South African soils with special reference to irrigation:
43/1:	- Structural stability of South African soils. 1972. J.L. Hutson
43/2:	- Use of soil stabilizers in the production of horticultural crops. 1974. J.L. Hutson
(A)S-Pr.45:	Ameliorasie van grond en water vir beter benutting onder besproeiingstoestande in Suid-Afrika:
45/1:	- Bepaling van die invloed van uitruilbare katione, waterkwaliteit en elektrolietkonsentrasie op die struktuurstabiliteit van grond op beoogde besproeiingskemas. 1972. H.M. du Plessis
45/3:	- Bepaling van die verwantskappe tussen grond- en watereienskappe asook struktuurstabiliteit van die grond op geselekteerde grondmonsters van die potensiaalbodemopname. 1972. H.M. du Plessis
(A)S-Pr.51/1:	Beweging en reaksie van afwaters (insluitend gesuspendeerde vaste stowwe) in gronde: Ontwikkeling van veld- en laboratoriummetodes vir die evaluering en voorspelling van afwaterbeweging in 'n reeks Suid-Afrikaanse gronde. 1974. J.L. Hutson, H.M. du Plessis, B.J. Joubert
(A)S-Pr.55/2:	Mineralogical and chemical properties of South African soils: Study of iron and titanium oxides in soils and synthetic materials. 1976. R. Eicker
O-Gl.139:	Bepaling van chemiese en fisiese norme vir verskillende grondseries met die oog op optimale gewasproduksie onder verskillende bewerkingspraktyke:
*139/1:	- Invloed van verskillende peile melassemeel op die chemiese en fisiese eienskappe van verskillende grondseries en op die verbouing van verskillende gewasse onder besproeiing. 1973. A. van Schalkwyk, M. van Z. Pellissier

GRONDE

O-Gl.139/2 - Invloed van verdigting op die fisiese eienskappe van die Shorrocks grondserie en op die voeding van verskillende gewasse onder besproeiing te Sandvet. 1972. P.J. Snyman, A. van Schalkwyk

139/3: - Potassium studies on various soils on various soils in the Orange Free State. 1971. T. Botha

139/4: - Ondersoek na bepalings van fisiese eienskappe wat geskik is om die effek van verdigting op gronde te evalueer. 1976. G.N. Krynauw

139/5: - Invloed van verskillende besproeiingspeile op die graad van grondverdigting. 1976. G.N. Krynauw

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139/2: - Karakterisering van gronde onder besproeiing in die Winterreënstreek ten opsigte van die fisiese en chemiese eienskappe wat hul grondvoghuishouding bepaal. 1975. D.J. Beukes

*139/4: - Gedrag van 'n verdigte en verbrakte fynsand grond in die Riversdalvoorligtingswyk na behandeling met sekere chemiese en organiese verbeteringsmiddels. 1976. J.H. Moolman

GRONDFISIKA/SOIL PHYSICS

W-Sb.139/5: Rol wat die fynsandfraksie speel in die verdigting van fynsandgrond in die Winterreënstreek. 1976. J.H. Moolman

GRONDONTLEDING/SOIL ANALYSIS

(A)S-Pr.53: Nasionale koördinering en navorsing in verband met die bemestingsadviesdienste ten behoewe van boere:

53/3: - Bepaling van 'n basis waarvolgens die gronde van die Republiek van Suid-Afrika sinvol gegroepeer kan word vir doeleindes van grondvrugbaarheidsevaluering met grondontledingsmetodes. 1975. A.J. van der Merwe

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W-Sb.132/1: Systematic study of the properties of selected soil series in the Winter Rainfall Region: The macro-element status of soils of the Winter Rainfall Region. 1968. G.R. Thompson

(S)WP.223: Studies in verband met skeikundige en fisiese analitiese metodes:

223/1: - Aanwending van selektiewe ioonelektrodes vir bepaling van voedingstowwe in gronde. 1977. J.J.A. Bester

GRONDSUURHEID/SOIL ACIDITY

(S)WP.170/9: Reaksie wat toegediende plantvoedingstowwe in gronde ondergaan: Bepaling van die grondreaksievereiste van sagtevrugte, en kalkbehoefte van boordgronde in Wes-Kaapland. 1974. W.A.G. Kotzé

GRONDVOG/SOIL MOISTURE

(A)S-Pr.44: Evapotranspiration and water-use studies by means of weighing lysimeters:

(A)S-Pr.44/2: - Evapotranspiration of certain crops at Roodeplaat as a function of soil, plant and atmospheric conditions. 1976. G.C. Green, J.L. Hutson, A Streutker

(A)S-Pr.46: Bepaling van norme vir ontwerp en bestuur van besproeiingstelsels vir gewasproduksie:

46/1: - Bepaling van grondvogprofiele en brakverspreiding onder mikrobesproeiing. 1972. A. Streutker

46/2: - Ondersoek van vloed- en sprinkelbesproeiingstelsels. 1973. A. Streutker

46/3: Meting van grondvogverbruik in verhouding tot oesopbrengs. 1976. A. Streutker

N-Ce.130/1: Irrigation requirements of agronomic crops on soils of the Natal Region: Moisture characteristics and infiltration rates of irrigable soils occurring in the Natal Region. 1973. R. Mottram

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(S)WP.219: Bepaling van grondvog en -digtheid met behulp van gamma-attenuasie. 1975. J.H.M. Karsten

W-Sb.139: Bepaling van die besproeiingswaterbehoefte en die verbetering van waterhuishouding van produserende en nie-produserende gronde in die Winterreënstreek:

139/3: - Grond-water-plantverhoudings - Grondvoghuishoudingstudies onder verskillende grondvogregimes en die effek van laasgenoemde op geselekteerde fisiologiese en anatomiese groei-eienskappe van plante. 1974. D.J. Beukes

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(A)S-Pr.49/1: Storage of resource and land-use inventory of the Johannesburg-Pretoria complex. 1973. K.P. Taylor, C.N. MacVicar, B.C. Geers, J.F. Eloff, A.B. Oosthuizen, T.U. Yager

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(S)WP.221: Systematic study of the properties of selected soil series in the Winter Rainfall Region: Classification and mapping of soils on experiment farms of the Fruit and Fruit Technology Research Institute. 1971. J. Wooldridge

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*147/2: - Klassifikasie op serie- en fasevlak van die gronde van die Hexvallei. 1975. D.J. le Roux

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(A)I-Pr.80/3: Biologie van die grond (dierkundige aspekte): Opname van die Suid-Afrikaanse nematodefauna en opbou van 'n permanente Nasionale Versameling met aandag aan ekologie en invloed op grondvrugbaarheid. 1962. Ester van den Berg, Jadmiga Plisko

(A)PS-Pr.21: Studies met stikstofbindende bakterieë in Suid-Afrikaanse gronde:

21/2: - Uittoets van kommersiële peulplantentstowwe. 1967. B.W. Strydom, H.J. van Rensburg

21/7: - Selektering van *Rhizobium*-rasse vir entstofvervaardiging. 1968. B.W. Strydom, C.J. Otto

21/16: - Seleksie van weerstandbediende *Rhizobium*-rasse teen ongunstige klimaatstoestande. 1974. H.J. van Rensburg, B.W. Strydom

(A)PS-Pr. 21/18: - Ondersoek na die rol wat lektiene speel by spesifisiteitsbepaling van rhizobia. 1973. I.J. Law, B.W. Strydom

21/19: - Ontwikkeling van metodes vir die seleksie van *Rhizobium*-rasse vir entstowwe. 1975. H.J. van Rensburg, B.W. Strydom

21/20: - Relative importance of nitrogen-fixing ability in *Rhizobium* strain selection. 1976. I.J. Law, B.W. Strydom

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(A)PS-Pr.44: Bydrae van vrylewende stikstofbindende mikro-organismes tot Suid-Afrikaanse gronde:

44/1: - Evaluering van stikstofbinding by grasse wat vir weidingsdoeleindes aanbeveel word. 1975. J.L. Staphorst, B.W. Strydom

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256/1: - Taxonomy and ecology of the Collembola in the Winter Rainfall Region. 1966. M.C. Walters

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W-Sb.125/1: Evaluering van die mikro-elementstatus van gronde en verwante gewasproduksieprobleme in die Winterreënstreek. 1967. C.P. de L. Beyers

RADIO-ISOTOPE/RADIO ISOTOPES

(S)WP.245/3: Radioïsotopie: Gebruik van radioïsotope in die landbou: Bepaling van molibdeen en scandium in gronde en plante deur neutronaktivering. 1978. W.A.G. Kotzé

245/4: - Scandium-46 en Gallium-67 as merkers vir aluminium in grond- en plantstudies. 1978. W.A.G. Kotzé

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N-Ce.141/1: Wetland development in the Natal Region: Evaluation of ridge and furrow technique for wetland development. 1975. D.M. Scotney, A.D. Lyle, P.A.F. Wilby

VRUGBAARHEID/FERTILITY

(A)S-Pr.53: Nasionale koördinering en navorsing in verband met die bemestingsadviesdienste ten behoewe van boere:

53/1: - Koördinering van die bemestingsadviesdienste in die Republiek van Suid-Afrika. 1976. A.J. van der Merwe

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106/21: - N, P and K economic optima for maize grown on a Msinga sandy clay loam. 1972. M.P.W. Farina, P. Channon

106/22: - N, P and K economic optima for maize grown on a Bergville sandy clay loam. 1972. M.P.W. Farina, P. Channon

106/23: - Zinc, boron and copper requirements of maize grown on an Avalon medium sandy loam. 1972. M.P.W. Farina, P. Channon

*106/24: - Field scale test of experimentally established economic optima for N, P and K on an Avalon medium sandy loam. 1973. M.P.W. Farina

106/25: - Comparison of four phosphate carriers for maize on an Avalon medium sandy loam. 1973. M.P.W. Farina, P. Channon

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180/2: - Grondvoorbereiding met kompos. 1972. G.K.G.E. Schliemann

180/3: - Evaluation of municipal compost. 1971. G.K. Schliemann

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180/5: - Destruction of weeds in municipal compost. 1974. G.K. Schliemann

*W-Sb.125/3: Evaluering van die mikro-elementstatus van gronde en verwante gewasproduksieprobleme in die Winterreënstreek: Evaluering van die swawelstatus van geselekteerde grondseries in die Winterreënstreek. 1974. C.P. de L. Beyers

*W-Tk.6/1: Bemestingsaspekte van aangeplante en natuurlike weidings in die Winterreënstreek: Ondersoek na die fosforstatus en kalkbehoefte van die verskillende grondvorms (series) waarop meerjarige lusern/medic-weidings gevestig sal word. 1975. C.P. de L. Beyers

INGENIEURSWESE/ENGINEERING

BESPROEIING/IRRIGATION

(A)L-MI.27/2: Bepaling van 'n ontwerpformule en vasstelling van kriteria vir die ontwerp van vloedbesproeiingsbeddings:Toetsing en verbetering van die vloedbesproeiingsontwerpformule. 1973. G.R. Potgieter

(A)L-MI.29/2: Ondersoek na die huidige toestand van beddingsbesproeiing in Suid-Afrika: Die Olifantsrivierbesproeiingskema (Vredendal). 1974. A.M. Meyer

(A)L-MI.41: Evaluering van sprinkelbesproeiingstelsels in Suid-Afrika:

41/1: - Opstel van 'n evalueringsprosedure vir sprinkelbesproeiing. 1973. J.H. Eckhard

41/2: - Sprinkelbesproeiingstelsels in die Loskopdamskema. 1973. J.H. Eckhard

41/3: - Kies van die mees ekonomiese pyp vir verskillende pomptempos. 1973. J.H. Eckhard

41/4: - Bepaling van druppelgrootteverspreiding met verskillende tuite. 1974. J.H. Eckhard

INGENIEURSWESE

41/5: - Bepaling van verdampingsverliese by sprinkelbesproeiing. 1974. J.H. Eckhard

41/6: - Sprinkelbesproeiingsverliese in die Douglas-gebied. 1973. J.H. Eckhard

41/7: - Evaluering van sprinkelbesproeiing in die voorligtingswyke Stellenbosch en Wellington. 1974. A.M. Meyer

41/8: - Sprinkelbesproeiingstelsels in Natal. 1973. P.J. McPhee

(A)L-MI.45: Ondersoek na ingenieursaspekte van drupbesproeiing in die Republiek van Suid-Afrika:

45/1: - Veldopname van drupbesproeiingstelsels. 1974

45/2: - Werkverrigting van Blass-tipe druppers. 1974. L.R. Venter

45/3: - Werkverrigting van mikrobuise. 1974. W.J. Uys

GRONDBEWARING/SOIL CONSERVATION

(A)L-MI.23: Stabilisering van slote:

23/1: - Stabilisering met plantegroei ondersteun deur klein meganiese strukture (Nieuwejaarspruit). 1968. S.W. Jacobsz, C.P.M. de Villiers

23/2: - Stabilisering met groot onderdalwegwerke en plantegroei. 1968. S.W. Jacobsz, C.P.M. de Villiers

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(A)L-MI.24: Studie van sedimenthellings en die opbouing daarvan stroom-op van grondbewardingswerke. 1958. F.S. Greyvenstein, C.P.M. de Villiers

(A)L-MI.54: Ontwerpsnorme vir grondbewaringstrukture, Winterreënstreek.

54/1: - Ontwikkeling van reënvalintensiteitsfrekwensiekurwes. 1976. J.F. la G. Mattheé

54/2: - Evaluasie van poliëtileen-bedekte afleibaan. 1976. J.F. la G. Mattheé

54/3: - Evaluasie van betonafleibane in die Swartland. 1976. J.F. la G. Matheé

GRONDDREINERING/SOIL DRAINAGE

(A)L-MI.55: Evaluasie van die ingenieursfasette van ondergrondse dreineerstelsels:

55/1: - Evaluering van moderne dreineringsteorie vir die ontwerp van ondergrondse dreineerstelsels in die Winterreënstreek. 1977. R.P. Perold

LANDBOUMEGANISASIE/AGRICULTURAL MECHANIZATION

APPARAAT/APPARATUS

(A)L-MI.52: Ontwikkeling van plaagbeheertoerusting.

52/1: - Ontwikkeling van 'n ultra-laevolume sprinkaanspuitmasjien. 1975. F.J.C. Hugo

52/2: - Ontwikkeling van ULV rugsaksprinkaanspuit. 1976. F.J.C. Hugo

(A)I-Pr.114: Design and testing of equipment for the processing of honey. 1972. R.H. Anderson, (A)L-MI.46/1: Fasiliteite vir die verwerking van suiwelprodukte: Behoeftebepaling ten opsigte van ingenieursfasette in die Suid-Afrikaanse suiwelbedryf. 1974. D.C. van der Walt

(A)L-MI.49: Ondersoek na toerusting vir die ontwatering van vrugte en verwante plaasprodukte:

49/1: - Evaluasie van die Californiese tipe droogtonnels te Citrusdal Koöperatiewe Droogbane. 1974. P.J.C. Bosch

ONTWATERING/DEHYDRATION

(A)L-MI.49/4: Investigation of equipment for dehydration of fruit and allied farm products: Simulation of a Californian dehydration tunnel. 1976. P.J.C. Bosch

PLAASMASJINERIE/FARM MACHINERY

(A)L-MI.21: Toetse en studies van voerstropers wat in die Republiek van Suid-Afrika gebruik word. 1967. P.R. Atkins

(A)L-MI.38: Toets van sprinkelaars met pypverbindings kleiner as 26 mm

38/1: - Opstel van 'n toetsprosedure. 1973. F. de K. Geertsema

38/2: - Opstel van 'n rekenaarprogram vir die verwerking van die sprinkelaartoetsgegewens. 1972. J.N. de Bruin

38/3: - Toets van sprinkelaar Alpha. 1974. F. de K. Geertsema

38/4: - Ontwikkeling van 'n versnelde duursaamheidstoets vir sprinkelaars. 1974. J.H. Eckhard

(A)L-MI.47/4: Melkvervoer en -aflewering: Daarstelling van minimum wasgerieweverеistes vir melktenkwaens in Suid-Afrika. 1974. D.C. van der Walt, J. Veenstra

LANDBOUWEERKUNDE/AGROCLIMATOLOGY

EVAPOTRANSPIRASIESTUDIES/EVAPOTRANSPIRATION STUDIES

(A)S-Pr.44/1: Determination of the evapotranspiration and water use of plants by means of weighing lysimeters: Design and construction of lysimeters. 1973. J.L. Hutson

(A)S-Pr.50: Agroklimaatsbepaling in die Republiek van Suid-Afrika:

*50/7: - Ontleding en kartering van verdamping. 1973. A.V. Kotze, A.L. du Pisani

(A)S-Pr.59/1: Verdamping en evapotranspirasie: Evapotranspirasie by peerbome op dwergonderstamme. 1971. G.W. Matthee

(S)N.99: Studie van grondvoghuishouding in verskillende grondsoorte onder verbouing van subtropiese gewasse:

99/1: - Verdampingstenks as maatstaf van evapotranspirasie by sitrus. 1968. G.S. Bredell

99/2: - Piesang. 1969. G.S. Bredell

99/3: - Macadamia. 1976. G.S. Bredell

GRONDVOG/SOIL MOISTURE

*(A)S-Pr.54/3: Agroklimaat van die Hoëveld- en O.V.S. streke: Bepaling en klassifikasie van vogvoorsieningspotensiaal van die streke. 1976. A.L. du Pisani

HAEL/HAIL

(A)S-Pr.54/2:	Agroklimaat van die Hoëveld- en O.V.S. streke: Identifikasie van haelsones. 1976. A.L. du Pisani

KLIMAAT/CLIMATE

(A)S-Pr.50:	Agroklimaatsbepaling in die Republiek van Suid-Afrika:
50/2:	- Waarskynlike maandelikse reënval. 1973. A.L. du Pisani, A.V. Kotze, A.P.J.J. Klopper
*50/3:	- Kartering van waarskynlike seisoensreënval. 1973. A.L. du Pisani, A.V. Kotze, A.P.J.J. Klopper
*50/4:	- Waarskynlike plantreënvaldatums. 1973. A.L. du Pisani, A.V. Kotze, A.P.J.J. Klopper
*50/5:	- Bepaling en kartering van die waarskynlike rypvryseisoen. 1973. A.L. du Pisani A.V. Kotze, A.P.J.J. Klopper
*50/6:	- Bepaling en kartering van hitte-eenhede en fototermiese eenhede vir wisselende groeiseisoene. 1973. A.L. du Pisani, A.V. Kotze, A.P.J.J. Klopper
*50/8:	- Ondersoek van dorheidsindekse in die Republiek van Suid-Afrika. 1973. A.L. du Pisani, A.V. Kotze, A.P.J.J. Klopper
(A)S-Pr.57/3:	Agroklimaat van die Hoëveld- en O.V.S. streke. Wisselwerking tussen makro en mikroklimaat en die groei van mielies. 1974. J.F. Erasmus
(A)S-Pr.58/2:	Verbetering van mikroklimaat: Mikroklimaatstudie van die Theewaterskloofdamterrein. 1972. G.K. Viljoen
*K-Gf.93/1:	Studie van die verband tussen biologiese verskynsels en klimaatselemente in die Karoostreek: Versameling en kodifisering van die klimaatsgegewens. 1963. J. Pollock
K-Gf.117/1:	Invloed van klimaat op plantegroei in die Karoo: Ses veldsoorte op Landboukollege Grootfontein. 1970. J.M. Torr
*N-Ce.137:	Agrometeorological surveys and studies in the Natal Region:
*137/1:	- Data recording and storing. 1974. W.H. Reynolds 1974. J. Erasmus
*(S)WP-BD.60/1:	Omlyning en beskrywing van agroklimaatsgebiede van Suidwes-Kaapland: Insameling van klimaatsgegewens. 1972. G.W. Matthee

TEMPERATUUR/TEMPERATURE

*(A)S-Pr.54/5:	Agroklimaat van die Hoëveld- en O.V.S.-streke: Verspreiding van minimum temperature te Douglas en voorspelling daarvan. 1976. R. Eicker

WEERTOESTAANDE/WEATHER CONDITIONS

(A)S-Pr.50/12:	Weer en klimaat in subtropiese vrugtegebiede: Daarstelling, bestuur van en data-insameling deur 'n netwerk van aanvullende weerstasies. 1972. C.P. Welgemoed, S.J. Bozalek
*(A)S-Pr.54/1:	Agroklimaat van die Hoëveld- en O.V.S. streke: Insameling en verwerking van weerkundigedata. 1976. F.G.L. Koch
(A)S-Pr.57/1:	Voorspelling van fenologiese gebeurtenisse: Korrelasie tussen weerfaktore en plukdatums van appels. 1973. G.W. Matthee

WINDSKERMSTELSELS/WIND-BREAK SYSTEMS

(A)S-Pr.58: Windletsels by sitrusvrugte:
- 58/1: - Evaluering van kunsmatige windbreke. 1972. G.K. Viljoen
- 58/5: - Wind surveys in areas concerned. 1969. S.J. Bozalek, C.P. Welgemoed
- 58/6: - Evaluation of windbreaks. 1974. S.J. Bozalek, C.P. Welgemoed, J.P. Carstens

PLANTBESKERMING/PLANT PROTECTION

Kyk ook betrokke gewasse en diere, en WEIDING/
See also respective crops and animals, and PASTURES

Insekte en verwante ongewerweldes/Insects and allied invertebrates

AALWURM/EELWORM

MONSTERNEMING/SAMPLING

(A)I-Pr.132/1: Studie van monsternemingstegnieke: Relatiewe doeltreffendheid van monster- en submonsternemingstegnieke vir aalwurmbevolkings, 1975. H. van Ark

ALGEMEEN/GENERAL

BESTUIWING/POLLINATION

(A)I-Pr.113: Role of insects in the pollination of seed crops in the Oudtshoorn area. 1972. R.H. Anderson

BIOLOGIESE BEHEER/BIOLOGICAL CONTROL

*(A)I-Pr.116: Insektebestryding deur virusse. 1972. V.H. Whitlock

NASIONALE VERSAMELING/NATIONAL COLLECTION

(A)I-Pr.123: Algemene versameling: Nasionale versameling van insekte. 1972. G.L. Prinsloo

PLAE/PESTS

(A)T-Rp.129: Diagnostiese ondersoek van plae wat tot dusver nie by tuinbougewasse in Suid-Afrika bekend is nie. 1970. C.C. Daiber

(S)N.128: New pests of subtropical crops:
- 128/1: - Pests of subtropical fruit and nuts. 1972. E.A. de Villiers, D.L. Milne

BLAARSPRINGERS/LEAF HOPPERS

H-Ps.258/2: Blaarspringers (Homoptera:Cicadellidae) as vektore: Bepaling van ekologiese optima vir die mieliebladspringer, *Cicadulina mbila*. 1977. G.D.J. van Rensburg

BLAASPOOTJIES/THRIPS

TAKSONOMIE/TAXONOMY

*(A)I-Pr.139:	Taksonomie en verspreiding van Suid-Afrikaanse blaaspootjies. 1976. E.K. Hartwig

BYE/BEES

BESTUIWING/POLLINATION

(A)I-Pr.119:	Behaviour of honeybees in orchards during pollination. 1973. R.H. Anderson

BIO-EKOLOGIE/BIO-ECOLOGY

(A)I-Pr.112/1:	Bio-ecology of solitary bees with reference to their importance as pollinating agents in South Africa: Carpenter bees. 1972. R.H. Watmough

BYEFLORA/BEE FLORA

(A)I-Pr.99:	Nectar and pollen flora of the Republic of South Africa: (See also pp 164 & 170)
99/1:	- Pollen analysis of honey. 1975. M.F. Johannsmeier
99/3:	- *Eucalyptus* spp. 1976. M.F. Johannsmeier
99/4:	- Field crops. 1975. M.F. Johannesmeier
99/5:	- Indigenous plants, ornamentals and weeds. 1975. M.F. Johannsmeier

AFRIKAANSE HEUNINGBY/AFRICAN HONEY BEE

(A)I-Pr.141:	Physiology, behaviour and ecology of the African honey-bee, *Apis mellifera adansonii* Latr.
141/1:	- Temperature relations of *A.m. adansonii*
141/2:	- Ecology of *A.m. adansonii* in the Drakensberg mountains of Natal
141/3:	- Development and behaviour of drones of *A.m. adansonii*
141/4:	- Swarming behaviour of *A.m. adansonii*
141/5:	Absconding and "migratory behaviour" *A.m. adansonii*
141/6:	- Natural emergency queen-rearing by the African bee, *Apis mellifera adansonii*, and its relevance to successful queen production by bee-keepers

KAAPSE HEUNINGBY/CAPE HONEY BEE

(A)I-Pr.94:	Development of laying workers in the Cape honeybee (*Apis mellifera capensis*) and their influence on the social organization of the colony. 1962. R.H. Anderson

KORFREKORDS/SCALE HIVE RECORDS

(A)I-Pr.99:	Nectar and pollen flora of the Republic of South Africa:
99/2:	- Scale-hive records. 1976. M.F. Johannsmeier

SIEKTES EN PLAE/DISEASES AND PESTS

(A)I-Pr.124: Siektes en plae van die heuningby:
- 124/2: - Broodsiektes van die heuningby. 1976. B. Buys
- 124/3: - Siektes van die volwasse heuningby. 1976. B. Buys
- 124/4: - Bestandheid teen siektes en plae in die seleksie van verbeterde lyne van heuningbye. 1975. B. Buys
- 124/5: - Plae van die volwasse heuningby. 1976. B. Buys

TEELLYNE/BREEDING LINES

(A)I-Pr.121: Selection of improved strains of honeybees. 1973. R.H. Anderson, B. Buys

VOEDING/FEEDING

(A)I-Pr.122: Stimulative feeding of honeybees. 1973. R.H. Anderson, M.F. Johannsmeier

DOPLUISE/SCALE INSECTS

TAKSONOMIE/TAXONOMY

(A)I-Pr.78: Taxonomy of African Coccoidea
- 78/1: - Systematic study of the Diaspididae. 1963. Y. Bev-Dov
- 78/2: - Taxonomy and distribution of South African Pseudococcoidea. 1963. G. de Lotto
- 78/3: - Taxonomy and distribution of South African coccoidea. 1964. G. de Lotto

KEWERS/BEETLES

BESTRYDING/CONTROL

(A)T-Rp.158/2/3: Investigation of the beetles belonging to the family Scarabaeidae: Development of techniques for the control of the larvae and adult beetles. 1975. J.M.I. Donaldson

OPNAMES/SURVEYS

A(I)-Pr.134/1: Studie van die voorkoms, aard en omvang van insekmiddelbestandheid by die belangrikste plaaginsekte van opgebergde graan in S.A. Insekmiddelbestandheid by *Tribolium* spesies. 1975. J.H. Viljoen

(A)T-Rp.158/2: Pest control studies: Scarabaeidae:
- 158/2/2: - A survey of populations. 1976. J.M.I. Donaldson

PROTOSTROPHUS

T-Rp.35: Studie van verteenwoordigende spesies van die genus Protostrophus:
- 35/1: - Verspreiding, skade en telingsmetodes. 1971. H.H. Gouse
- 35/2: - Biologiese en ekologiese studies. 1971. H.H. Gouse

SATURNIDAE

(A)I-Pr.126: Systematic studies on Saturnidae. 1974. H. Geertsema

MISWURMS/WHITE GRUBS

BESTRYDING/CONTROL

W-Vv.4: Chemiese bestryding van miswurms (fam. Agrotidea). 1956. S.S. Walters

MOTTE/MOTHS

BIO-EKOLOGIE/BIO-ECOLOGY

(A)I-Pr.87/3: Bio-ekologie of the potato tuber moth: Level of control now exerted by imported natural enemies and the measures, if any, needed to improve it. 1976. E.F. Whiteside

MYTE/MITES

BIO-EKOLOGIE/BIO-ECOLOGY

(A)I-Pr.77/1: Taksonomiese opname en bio-ekologiese studie van predatoriese myte in Suid-Afrika: Phytophage-predatoriese myte. 1962. Shiela C. Cruickshank, E. Ueckerman

SISTEMATIEK/SYSTEMATICS

(A)I-Pr.44: Sistematiek van myte van landboukundige belang. 1959. Magdalena K.P. Meyer

SPRINNEKOPPE/SPIDERS

SISTEMATIEK/SYSTEMATICS

(A)I-Pr.138: Sistematiek van spinnekoppe wat predatore van skadelike myte en insekte is. 1976. Ansie S. Dippenaar

TERMIETE/TERMITES

TAKSONOMIE/TAXONOMY

(A)I-Pr.10: Taxonomic studies of African Isoptera. 1946. J.E. Ruelle, W.G.H. Coaton

(A)I-Pr.11: National survey of the Isoptera. 1955. J.L. Sheasby, W.G.H. Coaton

SWAMKWEKERS/FUNGUS GROWERS

T-Rp.46: Swamkwekertermiete by landbougewasse:

46/1: - Opname van swamkwekertermiete by akkerbougewasse. 1977. H.H. Gouse

WESPES/WASPS

SISTEMATIEK/SYSTEMATICS

(A)I-Pr.108:	Systematics of African hymenopterous insects of the families Encyrtidae and Aphelinidae. 1970. D.P. Annecke, G.L. Prinsloo

Ongewenste plante/Undesirable plants

Kyk ook verskillende gewasse en Weiding/See also different crops and Pastures

ALGEMEEN/GENERAL

K-Gf.143:	Beheer van indringerplante. 1976. M. Vorster

BIOLOGIESE BEHEER/BIOLOGICAL CONTROL

(A)I-Pr.131:	Biological control of weeds.
131/1:	- Biological control of *Hakea sericea*, *H. gibbosa* and *H. suaveolens*. 1973. S. Neser
131/2:	- Biological control of *Hypericum perforatum*. (St. John's wort). 1973. S. Neser
(A)P-Pr.40:	Cytotaxonomic study of Lantana camara L. (Verbenaceae) in South Africa. 1975. C.H. Stirton

CHEMIESE BEHEER/CHEMICAL CONTROL

K-Gf.143/1(K):	Beheer van indringerplante/Control of invader plants: Chemiese beheer van mesquite *Proposis* spp. in die noordwes-Karoo. 1977. M. Vorster
OK-Do.86:	Chemical control of *Opuntia* spp.:
86/1:	- Study of the physiological and morphological characteristics of *Opuntia aurantiaca*. 1977. B.H. Whiting
W-Sb.77/5:	Chemical weed control in winter cereal crops: Chemical and cultural control of *Avena*, *Bromus*, *Lolium* and other problem weeds in small grain in the Winter Rainfall Region. 1974. A.L.P. Cairns, J.E. Wicht

EKOLOGIE/ECOLOGY

(A)P-Sb.5/2:	Botanical survey of the mountain fynbos of South Africa: Distribution and autecological aspects of the *Hakea* pest plants, *H.sericea*, *H.gibbosa* and *H. suaveolens*. 1976. S.R. Fugler

MIDDELS/HERBICIDES

WEERSOMSTANDIGHEDE/WEATHER CONDITION

(A)T-Rp.142:	Invloed van temperatuur op die uitwerking van onkruidmiddels op verskillende cultivars van groentegewasse. 1972. W.M.D.R. Meissner

PROSOPIS

K-Gf.126/2: Plantekologie: Opname van *Prosopis* verspreiding in die Karoostreek. 1977. M. Vorster

UINTJIES/NUTGRASS

BESTRYDING/CONTROL

(A)T-Rp.115/1: Onkruidbestryding in tuingewasse: Bestryding van uintjies (*Cyperus* spp). 1967. O.J. Olivier, P.J. Henrico

Plaagdoders/Pesticides

AANWENDING/APPLICATION

(A)I-Pr.24: Beheer van insekte in opgebergde saad en saadprodukte:

- 24/1: - Gebruik van kontakmiddels vir die beheer van insekte. 1955. J.H. Viljoen
- 24/2: - Gebruik van berokingsmiddels vir die beheer van saadbesmettende insekte. 1959. J.H. Viljoen

NABLYWING/PERSISTENCE

(A)I-Pr.97/8: Afbreking en vermindering van plaagbeheermiddelreste: Die neerslag en nablywing van plaagdoders aangewend met outomatiese spuitmasjiene op sitrus . 1976. P.R. de Beer, L.P. van Dyk

- 97/9: - Afbreking en vermindering van plaagbeheerreste: Residu's in rou groente en diereprodukte. 1977. L.P. van Dyk, P.R. de Beer, F.E. Pick
- 97/10: - Vergelyking van lae- en hoëvolume -handbespuiting ten opsigte van neerslag en nablywing. 1977. H. Schlebusch, M. Krause, L.P. van Dyk

TOEDIENINGSTEGNIEKE/APPLICATION TECHNIQUES

(A)I-Pr.140: Ontwikkeling van toedingstegnieke van landbouchemikalie:

- *140/1: - Sweef van insektemiddel met betrekking tot druppelgrootte van variërende metereologiese toestande. 1977. N.H.S. Pretorius

VEROUDERING/AGEING

(A)I-Pr.97/7: Afbreking en vermindering van plaagbeheermiddelsreste: Veroudering van labiele plaagdoders in verskillende formulerings en onder verskillende stoortoestande. 1975. L.P. van Dyk

WAARDEBEPALING/EVALUATION

(A)I-Pr.106: Toets van insektemiddels en toedieningsmetodes teen die bruinsprinkaan:

(A)T-Rp.158/2: Plaagbeheerstudies. 1975. M.C. Bolton

- 158/2/1: - Diagnostiese ondersoek na plae en evaluering van beheermiddels. 1975. M.C. Bolton

(A)T-Rp.112:	Evaluation of new plant protection compounds on horticultural crops in the summer rainfall area:
112/1:	- Fungicide tests. 1967. B.H. Boelema, S. Visser
112/2:	- Insecticide tests. 1967. C.C. Daiber

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Kyk ook betrokke gewasse/See also respective crops)

ALGEMEEN/GENERAL

(A)PS-Pr.40:	Downy mildew fungi of maize and sorghum in South Africa. 1971. G.C.A. van der Westhuizen
(A)PS.Pr.42/1:	Plantbeskermingsmaatreëls teen kleingraansiektes: Nasionale waarnemingsproewe. 1974. J.N.W. de Jager

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(A)PS-Pr.41:	Studies oor saadgedraagde swamsiektes en hul bestryding in Suid-Afrika. 1975
41/1:	- Fungus flora of onion seed. 1973. G.C.A. van der Westhuizen
41/2:	- Voorkoms van patogene swamme op diverse plaaslik geproduseerde en ingevoerde saadmonsters. 1975. M.A. Holtzhauzen
*41/3:	- Studie van saadgedraagde swamsiektes van Japanse radyssaad en hul beheer in Suid-Afrika. 1975. M.A. Holtzhauzen (sien Voergewasse/see Forage Crops)
(S)N.141:	Ekto- en endotrofiese mikorrisas van sitrus en subtropiese gewasse:
141/1:	- Endogonaceae in die Laeveld. 1976. R. Mataré

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(A)P-Pr.30:	Compilation of an ecological bibliography for Southern Africa. 1969. D.J.B. Killick, D. Edwards

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(A)P-Pr.22:	Stability of basal cover in natural grassland. 1966. J.W. Morris

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O-G1.32:	Opbou van 'n herbarium en bevordering van ekologiese studies van veldplante. 1950. L.F. Vorster, A.F.J. Visagie

OPNAMES/SURVEYS

(A)P-Db.3/1:	Ecological and ecophysiological studies on aquatic higher plants in South Africa: Classification and mapping of aquatic macrophyte communities of Natal. 1974. C.F. Musil

PLANTKUNDE

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(A)P-Pr.9:	Vegetation of protected plots in the Bantu areas of the Republic of South Africa. 1960. D. Edwards
(A)P-Pr.23:	Plant ecological survey of the Highveld Region:
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23/2:	- Kroonstad area. 1968. J.C. Scheepers
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38/1:	- Area between Richards's Bay and the Umfolozi River. 1976. P.J. Weisser
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(A)P-Sb.8:	Semi-detailed survey of the vegetation of the Western and Southern Cape Province Coastal Lowlands:
8/1:	- Study of a number of east to west transects through the Western Cape Coastal Lowlands. 1977. C. Boucher
8/2:	- Description and mapping of the Western Coastal Lowlands. 1978. C. Boucher
H-B1.65/1:	Weidingspotensiaal van die oostelike Hoëveldstreek: Plantkundige kaarte van subopvangsgebiede. 1971. J.A. Kruger
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(A)P-Pr.42:	Palaeo-ethnobotany of the Iron and Stone Age deposits of Border Cave, lebombo Range. 1976. J.M. Anderson

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(A)P-Pr.37/1:	Determination of Biomass relations in dominant tree and shrub species within the Savanna ecosystem project. 1975. M. Rutherford
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(A)P-Db.3/2:	Ecological and ecophysiological studies on higher aquatic plants in South Africa: Ecophysiological study of *Eichhornia crassipes* in Natal. 1974. C.F. Musil
3/3:	- Preliminary survey of aquatic plants in Transvaal. 1976. R. Crawford

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(A)P-Pr.26:	Anatomical study of the leaf and embryo of the Poaceae (Gramineae) of Southern Africa. 1972. R.P. Ellis
(A)P-Pr.27:	Sitotaksonomiese studie van die *Eragrostis curvula*-kompleks. 1972. T.B. Vorster
(A)P-Pr.29:	Revision of 'The Genera of South African Flowering Plants'. 1967. R.A. Dyer
(A)P-Pr.35:	Geïllustreerde flora van die Pretoria-distrik. 1970. O.A. Leistner, P.J. Vorster
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(A)P-Sb.9:	Taksonomies-morfologiese ondersoek van die seksie Campylia van die genus *Pelargonium*. 1976. L. Hugo
(A)PS-Pr.17:	Identifikasie en klassifikasie van Suid-Afrikaanse swamme:
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*17/3:	- Swamflora van *Cenchrus ciliaris*. 1975. Henrietha Bezuidenhout

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N-Ce.194:	Development of soil/plant/water analytical services for Natal Region:
194/1:	- Soil analysis services for fertilizer advisory purposes. 1977. R.J. Bennet, I. Rottcher, S. Minnaar
194/2:	- Herbage/animal feed analytical programme for research and extension. 1977. R.J. Bennet, I. Rottcher, S. Minnaar
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*(S)WP.145/2: Metodes vir die radiometriese analise van biologiese materiaal en gronde: Bepaling van die halveringstye van radio-isotyope. 1962. J.H.M. Karsten

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16/2: - Promotion of maize yields in bioclimatic group 8 in the Dundee soil conservative district. 1974. R.H. Read

16/7: - Promotion of improved maize yields in bioclimatic areas 2 and 3 of the Greytown extension area. 1975. D.L. Thibaud

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17/6: - Koringverbouing in die Bredasdorpse voorligtingswyk. 1972. L.M. Smit

17/7: - Koringverbouing in die George voorligtingswyk. 1973. W.G.J. Voigt

17/8: - Kleingraanproduksieprogram. 1972. P.N.J. Terblanche

17/9: - Kleingraanproduksieprogram in die Swellendam-Rûensgebied. 1973. J.P. Pietersen

*W-Vl.17/24: Kleingraandemonstrasies - Hermon. 1976. A.G. Snyman

17/25: - Kleingraan demonstrasieproewe in die Caledon Voorligtingswyk. 1976. F.J.J. Carstens

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*17/1: - Promotion and economic intensification of beef production in bioclimatic group 4 in the Underberg soil conservation district (budget feeding programme).. 1973. T.M. du Plessis

17/2: - Promotion of the economic intensification of beef production in the Swartberg section of East Griqualand in bioclimatic groups 4F and 4E. 1974. A.R. Bischof

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21/1: - Bloubuffelsgrasprogram vir die Odendaalsrus en Hoopstad voorligtingswyke. 1973. P.J.J. Basson

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OK-Vl.18/1: Bevordering van rooivleisproduksie in die Oos-Kaapstreek: Voorligtingswyk Aliwal-Noord. 1974. F.P. Nel

T-Vl.35: Ontwikkeling van aangepaste boerderystelsels vir die Transvaalstreek:

35/1: - Doeltreffendheid van varsmelkboerdery in Suidoos-Transvaal. 1975. J.C. Louw

35/2: - Ontwikkeling van aangepaste boerderystelsels vir die Eerstegoudteikengebied. 1975. S.E. Terblanche

T-V1.35/3: - Ontwerp van 'n volledige waterafloopbeheerstelsel vir die Eerstegoudteikengebied. 1975. S.W. Ackerman

35/4: - Formulering van 'n aangepaste en ekonomiese boerderystelsel vir die Kosterteikengebied. 1975. A.P. Conradie

35/5: - Ontwerp van 'n waterafloopbeheerstelsel vir die Strydomblokteikengebied. 1975. C.O. Loubser

35/6: - Ontwerp van 'n waterafloopbeheerstelsel vir die Sabie Vallei gebied. 1975. D.W. Nell

35/7: - Ontwikkeling van 'n doeltreffende aangepaste boerderystelsel vir die Strydomblok teikengebied. 1975. P.J. du Toit

35/8: - Ontwikkeling van 'n doeltreffende aangepaste boerderystelsel vir die Sabie Valleiteikengebied. 1975. C.C. Engelbrecht

*35/9: - Formulering van aangepaste boerderystelsels vir die Cullinan-Noordteikengebied. 1975. R. Böhringer

35/10: - Ontwikkeling van 'n aangepaste boerderystelsel vir die Kendalgebied. 1975. J.S. Leonard

35/11: - Ontwerp van 'n waterafloopbeheerstelsel vir die Badplaaskomteikengebied. 1975. K.P. de Beer

35/12: - Ontwerp van 'n waterafloopbeheerstelsel vir die Van der Merwesdriftteikengebied. 1975. H.P. van Dulk

35/13: - Ontwerp van 'n waterafloopbeheerstelsel vir die Kleinkomatiteikengebied. 1975. J.E. Farrell

35/14: - Ontwikkeling van 'n aangepaste boerderystelsel vir die Groot Olifantsteikengebied. 1975. M.J. Bekker

35/16: - Ontwerp van 'n waterafloopbeheerstelsel vir die Kendalteikengebied. 1975. G.J. Mentz

35/18: - Ontwerp van 'n waterafloopbeheerstelsel in die Bokpoortteikengebied. 1975. J. Bellingan

35/19: - Ontwerp van 'n waterafloopbeheerstelsel vir die Annysspruitteikengebied. 1975. F.J. Etsebeth

35/20: - Ontwerp van 'n waterafloopbeheerstelsel vir die Groot Olifantsteikengebied. 1975. D.W. Niemand

35/21: - Ontwerp van 'n waterafloopbeheerstelsel vir die Kafferspruitteikengebied. 1976. A.J. Smit

35/22: - Ontwikkeling van 'n aangepaste boerderystelsel vir die George's Valley-teikengebied. 1976. I. Jansen van Rensburg

35/23: - Ontwikkeling van 'n aangepaste boerderystelsel vir die Kafferspruit-teikengebied. 1976. D.J. van der Merwe

35/24: - Development of adapted farming systems for the Letaba Bushveld target area. 1977. W.B. Noel

35/25: - Ontwerp van 'n waterafloopbeheerstelsel vir die Georges Valley teikengebied. 1976. C.P.J. de Jager

*35/26: - Ontwerp van aangepaste boerderypraktyke in Wolwekraal-teikengebied. 1977. N.A. Haddad

35/28: - Ontwerp van 'n doeltreffende waterafloopbeheerbeplanning vir die Almateikengebied. 1977. J.T. Nel

35/29: - Ontwerp van aangepaste boerderypraktyke vir die Watervalsrivierteikengebied. 1977. B.P. Swart

T-Vl.36: Kommunikasie van aangepaste boerderystelsels en praktyke in die Transvaalstreek:
- 36/1: - Kommunikasieprogram vir die bevordering van doeltreffende veld- en veebestuurspraktyke in die Thabazimbi Bosveld. 1975. G.J.G. du Plooy
- 36/2: - Kommunikasie van verbeterde veeboerderypraktyke in die Koedoesrandteikengebied. 1976. S.W. Burger

W-Lg.13: Optimum integration of farming practices:
- 13/1: - Swartland optimum land utilization and management trial. 1972. J.E. Wicht, T.T. de Villiers, M.D. Strauss, J.M. van Heerden
- 13/2: - Evaluation of practices to determine the most suitable cultivation for optimum yield in different wheat rotation systems as practised in the Swartland. 1975. J.E. Wicht, J.H. Loots, M.M. Landman

W-Vl.17: Bevordering van landbouproduksie in die Winterreënstreek:
- *17/16: - Verbetering van wingerdboupraktyke op die Olifantsrivierbesproeiingskema. 1975. P.J. Els

BOERDERYREKORDS/FARMING RECORDS

W-Vl.17/30: Bevordering van landbouproduksie in die Winterreënstreek: Boerderyrekords vir Bredasdorp. 1973. D. Joubert, A. Marais, C.W.G. Goldswain

GRONDBEWARING/SOIL CONSERVATION

H-Vl.16: Afloopbeheerbeplanning in die ontwikkelingsgebied:
- 16/1: - Losdoorns. 1976. H.J. van Staden, A.H. Versfield
- 16/2: - Vermaas. 1975. H.J. van Staden, A.H. Versfeld
- 16/3: - Argent. 1975. H.J. van Staden, A.H. Versfeld
- 16/4: - Clocolan. 1976. H.J. van Staden, A.H. Versfeld
- 16/5: - Roadside. 1975. H.J. van Staden, A.M. Versfeld
- 16/6: - Rooipoort, 1975. H.J. van Staden, A.M. Versfeld
- 16/7: - Rooiwal. 1976. H.J. van Staden, A.H. Versfeld

N-Ce.139/4: Systems specifications and simulations for Extension use: Run-off and soil loss estimation model, 1976. D.M. Scotney. J.B. Mallett, R.I. Jones, P.J. McPhee, H. Elwell

N-Vl.13: Beskerming van landerye in Natalstreek. 1973. J.J. Bezuidenhout

N-Vl.19/1: Protection of excessively steep cultivated lands under sugarcane and horticultural crops in the Natal Region: Conservation programme for steep land farmed by Indians in the Natal coastal subregion. 1974. C.T. Thomas

OK-Vl.14: Beskerming van bewerkte grond teen erosie:
- 14/4: - Vestiging van droëlandlusern op bewerkte grond in die voorligtingswyk Molteno. 1972. I.W. van der Merwe
- 14/5: - Stutterheim magisterial district. 1973. B. Denyer
- 14/6: - Kontoerprogram vir bewerkte grond in die landdrosdistrik Alexandria. 1970. R.P. Laing
- *14/7: - Beskerming van landerye teen watererosie in die landdrosdistrik Humansdorp. 1971. J.P. van Zyl
- 14/8: - Beskermingsprogram in die Elandsriviergebied. 1970. L.O. Grobler

14/9: - Beskerming van landerye teen watererosie in die landdrosdistrik Sterkstroom. 1973. J.H. Fourie

14/10: - Voorligtingswyk Barkly-Oos. 1972. J.C. Scheltema

14/12: - Voorligtingswyk Aliwal-Noord. 1973. J.C. van der Walt

14/13: - Voorligtingswyk van Dordrecht. 1973. D.W. Schoeman

T-Vl.35: Ontwikkeling van aangepaste boerderystelsels vir die Transvaalstreek:

35/15: - Ontwerp van 'n waterafloopbeheerstelsel in die Kosterteikengebied. 1975. D.E. Misselhorn

T-Vl.35/27: Ontwikkeling van aangepaste boerderystelsels vir die Transvaalstreek: Die ontwerp van 'n waterafloopbeheerstelsel vir die Vlooikop-teikengebied. 1977. C.F.R. Swart

T-Vl.36/4: Kommunikasie van aangepaste boerderystelsels in die Traansvaalstreek: Kommunikasie van 'n doeltreffende afloopbeheerbeplanning vir die Kafferspruit-teikengebied. 1976. A.J. Smit

W-Vl.14: Meganiese beskerming van landbougrond in die Winterreënstreek:

14/1: - Ceres kontoerprojek. 1971. W.F. Marais

14/3: - Erosiebestryding in die Bo-Langkloof. 1974. C.J. Meiring

14/4: - Caledonvoorligtingswyk. 1974. J.J. Swart

14/5: - Beplanning van die Vleie-opvanggebied. 1968. G.J. van Zyl

14/6: - Hidrologiese beplanning van die Hartenbosdam-opvanggebied. 1972. D.J. Windsor

14/7: - Meganiese beskerming van landerye in die hoër reënvalstreek van Heidelberg. (Kaapprovinsie) en Riversdale. 1974. J. Kemp

14/8: - Meganiese beskerming van landerye in die Swellendamvoorligtingswyk. 1974. J.P. Pietersen, O.S. Lategan

14/9: - Erosiebestryding in die Bredasdorp-voorligtingswyk. 1975. P.R. Visser

14/10: - Afleibaanprogram - Durbanville. 1975. D. Muller, D.J. Venter, F.O. Haasbroek

14/12: - Winderosieprogram - Bergrivierplase. 1974. J.H.F. Roelofse

14/13: - Program vir die beskerming van skuinsgronde in die Koppiesveld-Vredenburg-grondbewaringsgebied. 1974. C.F. Vermeulen

14/14: - Program vir die beskerming van skuinsgronde in die koringwyk van die Moorreesburg-grondbewaringsgebied. 1974. C.F. Vermeulen

14/15: - Program vir die stabilisasie van waailande - Hopefield- en Vredenburg-grondbewaringsgebied. 1974. G.F. Vermeulen

14/17: - Winderosiebestryding - Graafwater. 1975. J.J. de Wet

14/18: - Meganiese en biologiese beskerming van saaigrond in die Wellingtonse voorligtingswyk. 1973. A.G. Snyman

14/19: - Meganiese en biologiese beskerming van saaigronde in die Tulbagh-grondbewaringsgebied. 1973. W. de V. Alheit

14/21: - Waterafloopbeheer in die Outeniquagebied. 1976. J.H. Blomerus

14/23: - Erosiebestryding op saailande - Montaguvoorligtingswyk. 1975. D.J. de Wit

W-Vl.15: Bepaling van die braksituasie in die Winterreënstreek:

15/1: - Bepaling van die omvang en oorsake van verbrakking in die Oudtshoorn-voorligtingswyk. 1973. B.F.A. Visser

W-Vl.15/2: - Karakterisering van verbrakte besproeiingsgronde en -water in die Oudtshoorn voorligtingswyk. 1974. P.C. van Rooyen

15/3: - Sistematiese ondersoek na die gehalte van besproeiingswater in die Montagu-voorligtingswyk. 1973. W.J. Basson

15/4: - Program vir die herwinning van brak in die Moorreesburg- en Hopefield-grondbewaringsgebied. 1974. C.F. Vermeulen

15/5: - Optimale landboukundige benutting van nat- en brakgronde deur fisiese beplanning. 1975. F.J. Saayman

W-Vl.16/6: Weidingsontwikkelingsprogram vir die Winterreënstreek: Erosiebestryding op saailande - Montagu-voorligtingswyk. 1975. D.J. de Wit

GRONDBEWARINGSKOMITEES - OPLEIDING/TRAINING OF SOIL CONSERVATION COMMITTEES

OK-Vl.15: Gemeenskapsontwikkeling:

*15/1: - Opleiding van grondbewaringskomitees. 1972. C.W. Smart, R. van Rhijn, G.D.H. Swart, F. Jordaan

DREINERING/DRAINAGE

W-Vl.14/20: Meganiese beskerming van landbougrond in die Winterreëenstreek: Dreineringsevaluasieprogram in die Boland Substreek. 1977. N.E.J. van Schalkwyk

GRONDKLASSIFIKASIE/SOIL CLASSIFICATION

H-Vl.14: Grondklassifikasie in ontwikkelingsgebiede in die Hoëveldstreek:

14/1: - Clocolan. 1974. G.B. Steyl, G. Postma, J.E. Volschenk

14/2: - Aberfeldy. 1974. B.H. Koch, J.E. Volschenk

14/3: - Roadside. 1974. B.H. Koch, J.E. Volschenk

14/4: - Vlakfontein. 1974. J. Joubert, J.E. Volschenk

*14/5: - Argent. 1974. L.M. le Roux, E.W. Hagedorn, J.E. Volschenk

*14/6: - Petrus Steyn. 1975. J.N. Mans, J.E. Volschenk

14/7: - Rooiwal. 1974. J.N. Mans, A.G.H. Kotzé, J.E. Volschenk

14/9: - Vierfontein. 1974. P.W.B. Joubert, J.E. Volschenk

14/10: - Diamantdoorns. 1975. A.H. Meyer, D.C.J. Uys, J.E. Volschenk

14/12: - Rooipoort. 1974. J. Joubert, J.E. Volschenk

14/13: Rooikrans. 1974. G.B. Steyl, J.E. Volschenk

14/14: - Eloff. 1974. L.M. le Roux, E.W. Hagedorn, J.E. Volschenk

W-Sb.147/3: Optimale hulpbronbenutting in die Winterreënstreek: Ondersoek na die natuurlike hulpbronne deur middel van grondklassifikasie met die oog op plaasbeplanning. 1975. J. van Zyl

W-Vl.15/6: Bepaling van die braksituasie in die Winterreënstreek: Gebruiksklassifikasie van besproeiingsgronde in die Kingnarivier-vallei, Montagu-voorligtingswyk. 1977. W.J. Basson

LANDBOUHULPBRONNE/AGRICULTURAL RESOURCES

K-Vl.16: Landbouhulpbronontwikkeling:

VOOORLIGTING

K-Vl.16/1: - Die rol van strewe as gedragsbepalende faktor by oortreders van die Grondbewaringswet in die Karoostreek. 1975. M.L. Heyns

LANDBOUPOTENSIAAL/AGRICULTURAL POTENTIAL

K-Vl.16: Landbouhulpbronontwikkeling:

16/2: - Studie van landboupotensiaal van Grassridgedam-opvanggebied in die Bo-Visrivierbekken. 1975. E.M. Meyer

16/3: - Studie van landboupotensiaal in die subopvanggebid van Loxton in die Sakrivier-opvanggebied. 1974. C.F. Visser, G.J.Z. Barnard

*O-Vl.11: Potensiaalbeskrywing van die Fauresmith-voorligtingswyk op basis van die landdrosdistrikte Philippolis, Jagersfontein en Fauresmith (Luckhoff ingesluit). 1971. J.F. Botha

OPTIMALE BENUTTING/OPTIMAL UTILISATION

N-Vl.15/1: Investigation of the Natal extension service for the promotion of optimum land use: 1975. D.M. Rix

*W-Sb.147/1: Optimale hulpbronbenutting in die Winterreënstreek: Uittoets van 'n prosedure in die Bo-Bergriviergebied. 1972. A. Viljoen, A.F. Kriel

PLAASBEPLANNING/FARM PLANNING

W-Sb.147/5: Optimale hulpbronontwikkeling in die Winterreënstreek: Oefening in plaasbeplanning - 'n model vir gemengde droëboerdery in die Rûensgebied. 1976. F.J.J. Carstens

SKAAPBOERDERY/SHEEP FARMING

OK-Vl.17/1: Kleinveebestuur: Bevordering van goeie bestuurspraktyke om 'n hoër lampersentasie by skape in die voorligtingswyk Adelaide te behaal. 1973. J.B. Marais

STELSELSPESIFIKASIES/SYSTEM SPECIFICATIONS

N-Ce.139/1: Systems specifications and simulations for extension use: Beef feeding simulator. 1975. R.I. Jones, S.F. Lesch, B.P. Louw

139/3: - Beef breeding herd simulator. 1976. B.J. Lyle, R.I. Jones, B.P. Louw, S.F. Lesch

N-Ce.139/6: Systems specifications and simulations for extension use: *Eragrostis curvula* production model. 1977. N.G.E. Hackland

SUIWELPRODUKSIE/DAIRY PRODUCTION

*N-Vl.18/1: Promotion of milk production in the Natal Region: Promotion of milk production in bioclimatic group 6 in the Newcastle extension area. 1974. W. Urquhart

W-Vl.17: Bevordering van landbouproduksie in die Winterreënstreek:

17/10: - Suiwelproduksieprogram in die George-voorligtingswyk. 1973. J.H. Blomerus

17/21: - Rekordhouding en die identifiseering van knelpunte in die suiwelbedryf in die Koeberg. 1975. F.O. Haasbroek

VELDBESTUUR/VELD MANAGEMENT

K-Vl.9/1: Veldverbetering: Evaluasie van die invloed van die veeverminderingskema op die veld in die voorligtingswyk:

9/1/1: - Cradock. 1972. M. Vorster

*9/1/2: - Graaff-Reinet. 1972. W.S. Loock

9/1/3: - Jansenville. 1972. I. du T. van der Merwe

9/1/4: - Somerset-Oos. 1972. F. Botha

9/1/5: - Burgersdorp. 1972. C.A. du Toit

9/1/6: - Colesberg. 1972. M.G. van Niekerk

9/1/7: - De Aar. 1972. J.G.M. van der Merwe

9/1/8: - Middelburg, Kaapprovinsie. 1972. M.J.A. Coetsee

9/1/9: - Calvinia. 1972. N. Nortjé

9/1/10: - Carnarvon. 1972. W. van D. Botha

9/1/11: - Kenhardt. 1972. D.J. Steenkamp

9/1/12: - Prieska. 1972. D.J. Roux

9/1/13: - Beaufort-Wes. 1972. A.P. Wiid

9/1/14: - Fraserburg. 1972. C.B. Reitz

9/1/15: - Laingsburg. 1972. I.J. van der Merwe

9/1/16: - Victoria-Wes. 1972. H.R. Becker

9/2: - Veldverbetering: Evaluasie van produktiwiteit van vee as gevolg van deelname aan die veeverminderingskema in die voorligtingswyk:

9/2/1: - Cradock. 1972. M.H. Vorster

9/2/2: - Graaff-Reinet. 1972. W.S. Loock

9/2/3: - Jansenville. 1972. I. du T. van der Merwe

9/2/4: - Somerset-Oos. 1972. F. Botha

9/2/5: - Burgersdorp. 1972. C.A. du Toit

9/2/6: - Colesberg. 1972. M.G. van Niekerk

9/2/7: - De Aar. 1972. J.G.M. van der Merwe

9/2/8: - Middelburg, Kaapprovinsie. 1972. M.J.A. Coetsee

9/2/9: - Calvinia. 1972. N. Nortjé

9/2/10: - Carnarvon. 1972. W. van D. Botha

9/2/11: - Kenhardt. 1972. D.J. Steenkamp

9/2/12: - Prieska. 1972. D.J. Roux

9/2/13: - Beaufort-Wes. 1972. A.P. Wiid

9/2/14: - Fraserburg. 1972. C.B. Reitz

9/2/15: - Laingsburg. 1972. I.J. van der Merwe

9/2/16: - Victoria-Wes. 1972. H.R. Becker

9/3: - Veldverbetering: Aktivering van boere in die voorligtingswyk Beaufort-Wes tot beter veldbenutting. 1974. A.P. Wiid

K-Vl.9/4: - Veldverbetering: Aktivering van boere in die voorligtingswyk Fraserburg tot beter benutting van weiveld. 1974. C.B. Reitz

9/5: - Veldverbetering: Aktivering van boere in die voorligtingswyk Victoria-Wes tot beter veldbenutting. 1974. H.R. Becker

9/6: - Veldverbetering: Aktivering van boere in die voorligtingswyk Laingsburg tot beter veldbenutting. 1974. I.J. van der Merwe

9/7: - Veldverbetering: Bevordering van gesonde weiveldbeheerpraktyke in die Williston grondbewaringsgebied. 1974. W. van D. Botha

K-Vl.12: Droogtebestande voergewasse:

*12/1: - Ondersoek na huidige omstandighede in die voorligtingswyk Jansenville. 1973. I. du T. van der Merwe

*12/2: - Voortplanting van droogtebestande voergewasse in die voorligtingswyk Jansenville. 1973. I. du T. van der Merwe

12/3: - Bevordering, vestiging en inskakeling van droogtebestande voergewasse in die boerderypatroon van die voorligtingswyk De Aar. 1974. J.G.M. van der Merwe

O-Vl.12/12: Ontwikkeling en bevordering van aangepaste boerderystelsel in die O.V.S.-streek: Evaluering van produksiestelsels in die Kalaharie-duineveld op die plaas Massakloutjie. 1977. N.J. de Wet, D.A. Boshof

O-Vl.12/13: Bevordering van oprigting van binnekampheinings in die sub-opvangsgebied Slykspruit. 1976. W. Jonker, A.J. van Schalkwyk

OK-Vl.13: Veldverbetering en -benutting:

13/1: - Gewenste grootvee tot kleinveeverhouding vir die voorligtingswyk Aliwal-Noord. 1972. O.V. Loest

13/2: - Wisselspaarprogram vir die voorligtingswyk Aliwal-Noord. 1972. O.V. Loest

13/3: - Realistiese veeladingsprogram vir die voorligtingswyk Aliwal-Noord. 1972. O.V. Loest

13/5: - Veld resting programme in the Queenstown extension ward. 1972. C.W. Smart

13/6: - Afkamp en behandeling van verspoelde dele in die voorligtingswyk Dordrecht. 1970. D.W. Schoeman

13/7: - Plaasbeplanning in die voorligtingswyk Barkly-Oos. 1973. J.C. Scheltema

13/8: - Bestrydingsprogram vir polgrasse (*Nasella trichotoma* en *Stipa tennuissima*) in die voorligtingswyk Barkly-Oos. 1972. J.C. Scheltema

13/10: - Promotion of the prevention and control of bush encroachment in the Albany soil conservation district. 1973. J.L. Clasey

13/11: - Afkamp van aktiewe waaisandkolle in die Humansdorp voorligtingswyk. 1973. H.H.D. Lourens

13/12: - Veldspaarprogram vir die bosveld van Uitenhage. 1971. L.O. Grobler

13/13: - Plaasbeplanning in die voorligtingswyk Aliwal-Noord. 1973. O.V. Loest

13/14: - Wisselspaarprogram vir die voorligtingswyk Barkly-Oos. 1972. J.C. Scheltema

13/15: - Afkamp en behandeling van verspoelde dele in die voorligtingswyk Aliwal-Noord. 1970. J.C. van der Walt

13/16: - Wisselspaarprogram vir die voorligtingswyk Molteno. 1972. J.W. van der Merwe

13/17: - Plaasbeplanning in die voorligtingswyk Dordrecht. 1973. D.W. Schoeman

13/18: - Wisselspaarprogram vir die voorligtingswyk Dordrecht. 1973. D.W. Schoeman

OK.Vl.13/20: - Plaasbeplanning in die voorligtingswyk Molteno. 1973. J.G. Stegmann

13/21: - Bevordering van die groepkampstelsel in die voorligtingswyk Molteno. 1973. I.W. van der Merwe

T-Vl.36/3: Kommunikasie van aangepaste boerderystelsels en praktyke in die Transvaalstreek: Kommunikasieprogram ter bevordering van verbeterde veld- en veebestuurspraktyke. 1976. C.S. Williams

W-Vl.16/7: Weidingsontwikkelingsprogram vir die Winterreënstreek: Versameling van inligting betreffende weiveld en beweidingspraktyke met behulp van inligtingsgroepe - Boesmanland-grondbewaringsdistrik. 1975. F.J.J. Brand

VRUGTE/FRUIT

W-Vl.17: Bevordering van landbouproduksie in die Winterreënstreek

*17/11: - Verbeterde wingerdboupraktyke in die Oudtshoornwyk. 1973. B.F.A. Visser

17/12: - Wingerdverbouing in die Montagu-voorligingswyk - Klein Karoo substreek. 1973. W.J. Basson

17/14: - Wingerdverbouingsprogram in die Ladismith-voorligtingswyk. 1972. M.J. Delport

*17/17: - Sitrusverbouing - Citrusdal. 1974. J.J. de Wet

17/19: - Ondersoek na verbeterde bemestingspraktyke by youngbessieverbouing. 1975. J.P. Pietersen

17/20: - Verbetering van die vruggrootte by kern- en steenvrugte in die Ceres, Tulbagh en Citrusdal vrugtegebiede. 1975. W.F. Marais

WEIDING/PASTURES

W-Vl.16: - Weidingsontwikkelingsprogram vir die Winterreënstreek:

16/1: - Bepaling van die kwaliteit van weiding in die Noordwestelike Substreek met behulp van objektiewe plantopnamemetodes. 1974. I.H. Kleingeld

16/2: - Weiveldverbetering in die Ladismith-Karoo grondbewaringsgebied. 1973. A.A. Schoeman

16/3: - Weiveldverbetering in die ekstensiewe gedeeltes van die voorligtingswyk Montagu. 1973. E.J.J. Nel

16/4: - Weiveldverbetering - Distrik Uniondale. 1974. C.J. Nel

16/5: - Veldherwinning in die Ceres-Karoo grondbewaringsgebied. 1971. W.F. Marais, P.A.B. van Breda

16/8: - Aanwending van aangeplante weiding op marginale gronde in die Stellenbosch-voorligtingswyk, wat nie vir permanente gewasverbouing geskik is nie. 1975. B.F. Smit, P.A.B. van Breda

16/10: - Bevordering van meerjarige weidings in Mosselbaailanddrosdistrik. 1976. W.G.J. Voigt

16/12(K): - Koöperatiewe grasklawer-demonstrasispersele onder besproeiing in die Touwsriviergebied. 1978. E.J.J. Nel, W.J. Basson